NATIONAL MUSEUM OF VICTORIA

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VICTORIA · · · AUSTRALIA

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(See September issue of this Journal.)

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Issued by direction of the Hon. E. J. Hogan, M.L.A., Minister of Agriculture.

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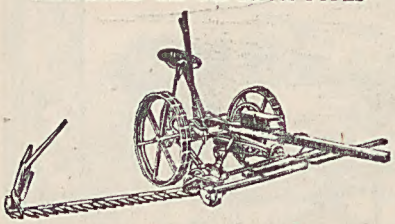

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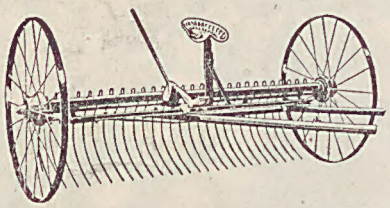

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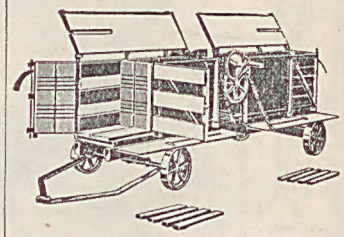

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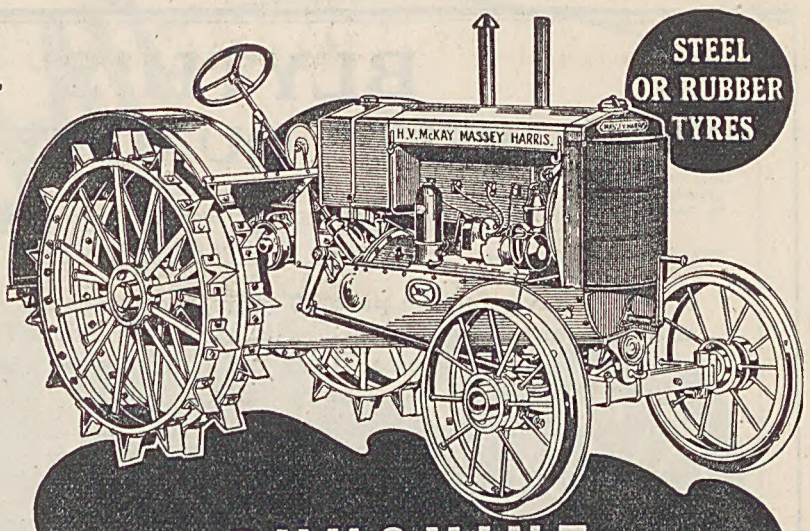
when you get it from a . . .



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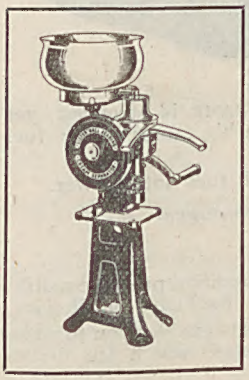

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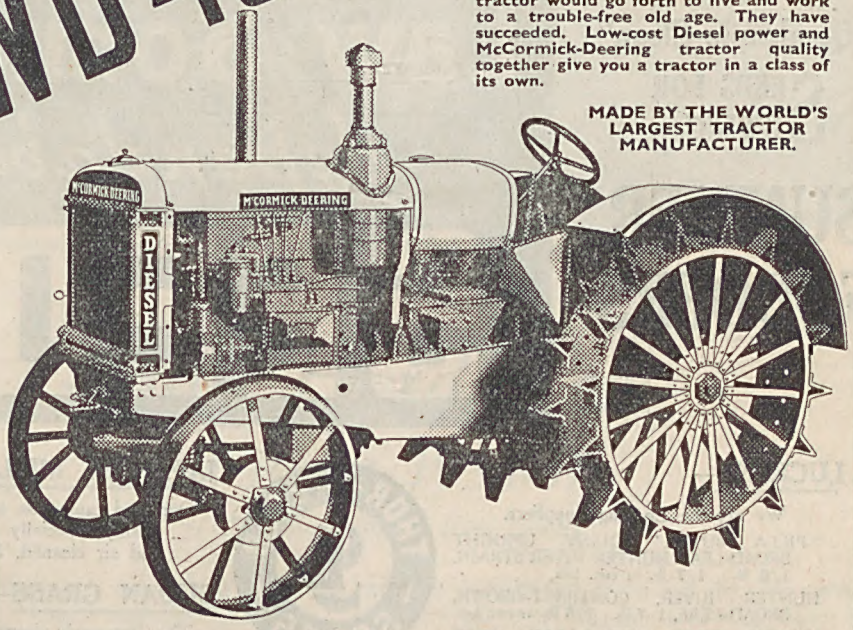

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GRIMM LUCERNE .. .. 3/6 lb.

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TRUE GIANT KANGAROO RAPE, 7½d. lb.; 65/4 cwt.

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SACCALINE, or SWEET SORGHUM, 5d. b.; 37/6 cwt.

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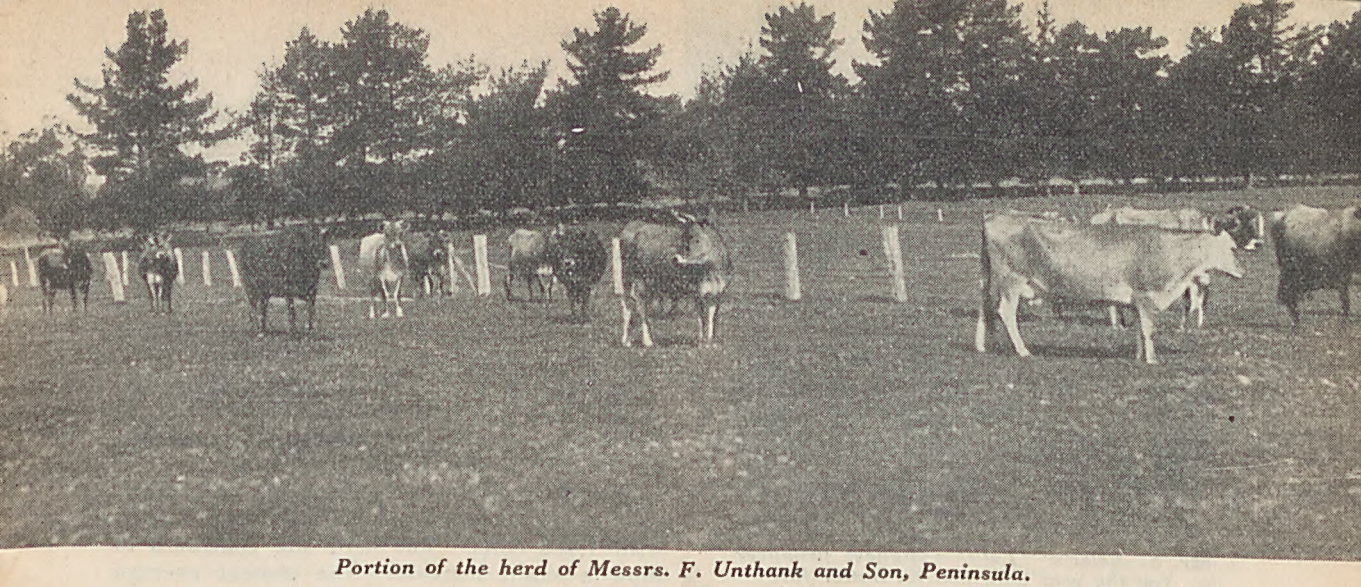

Portion of the herd of Messrs. F. Unthank and Son, Peninsula.

NATIONAL MUSEUM OF VICTORIA

Grade Herd Test

Annual Report, 1936-37

By W. J. Yuill, Supervisor of Herd Testing

UNUSUAL autumnal conditions have operated in south-western Victoria during the past two years. This has been particularly the case in the "mid-western" area at Colac-Camperdown. A slow growth of pastures followed the dry autumn of 1936, and very low production yields appeared certain. However, the outlook was entirely changed by the generous and persistent rains which fell during the late spring and early summer, after which dry conditions again set in.

The conditions referred to were largely responsible for the lower yields in the western portion of the State, as the very large number of autumn-calving cows in these areas did not make up for their months of low yields, even though splendid conditions prevailed during the latter portion of their lactation.

In those areas where spring-calving is the practice, conditions were ideal. For this reason, the tested cows in south-eastern Victoria exceeded the record year of 1931. The 261 butter-fat average of all cows there being above the average recorded in the irrigation areas in the previous year, and 3 lb. better than the average recorded there this year. Conditions in the north-eastern valleys were not suitable for high yields. Despite the variable conditions referred to, the average yield of all cows in the test was only 3 lb. below that of the record year of 1931.

Reference to the summary of the year's work on page 522 indicates that very little change has taken place in the volume of test work. New units have been organized at Winchelsea, Beeac, and Yarra Valley. The number of cows at present under test appears likely to exceed the figures of the last three years.

Tarwin Lower Association has seceded from the Victorian United Cow Testing Association, and is carrying on its own testing work. There are some weak units in various areas which need organizing into full strength in order that the work may be carried on at the lowest possible cost to members now testing, and so that lower fees may be charged intending members.

The record average yield of 247 lb. butter-fat for 89,619 cows made in 1931-32 still stands, although the average yield of all cows last year, and in 1934, was only 3 lb. lower. Owing to the unfavorable autumn conditions in Western Victoria, and in the North-East, much lower yields were recorded in these areas. In Gippsland, where the cows are mainly spring calvers, splendid yields were recorded. Thirty-eight

Mr. S. Esler's "Lulu"—Highest producer for the year with 686 lb. butter-fat.

units had an average yield exceeding 250 lb., including eleven with an average of more than 270 lb. butter-fat.

The top unit for the year was Rochester, with 767 cows, which averaged 311 lb. butter-fat. Stanhope No. 1 and Werribee South had average yields of more than 280 lb. per cow. The pioneer unit of the State, Yinnar No. 1, long ago reached the 300-lb. level and, despite the loss of old herds and the introduction of new ones, it leads the Gippsland group with an average return of 299 lb. butter-fat for 633 cows. This unit must look to its laurels, however, for Jindivick-Neerim No. 2 unit is but 7 lb. behind this average.

Maffra No. 1 is still the largest high-producing unit of the State. It's 1,143 cows averaged 289 lb —only 2 lb. ahead of Dumbalk North, where 1,064 cows completed the test. Ballarat and Condah each exceeded 260 lb. butter-fat average, while Gellibrand Valley, Winchelsea No. 1, Warrnambool, Cobden, Camperdown, and Apollo Bay were all over 250 lb.

Tallangatta No. 1 (270 lb.) and Eskdale No. 1 (262 lb.) hold the leading positions in the North-East, with both Swanpool units, and Eskdale No. 2 above the 250-lb. level.

Seventeen units are each testing more than 1,000 cows, the largest single unit being Noorat with 1,405 cows. The herd size continues to show a slight increase. The present average size of 34.3 cows doubtless expresses the improved feed conditions of the average farm, for the figure remained stationary at 29 cows per herd during the years 1929 to 1932.

The proportion of pure-bred bulls in use is the same as last year, 81 per cent. of all testing herds, an increase of 11 per cent. over the high figures of 1929-30. The introduction of the work of bull indexing suggests that herd-recording work can serve a still greater purpose than merely indicating each cow's potential yielding capacity. Of 200 bulls that have been indexed, at least one-third can be classed as unworthy individuals. Several keen herd testers are co-operating with the Department of Agriculture in this work.

SUMMARY OF HERD TEST ASSOCIATION DATA FOR YEAR ENDED 30TH JUNE, 1937.

Area.	Units.	Herds.	Cows.	Junior Cows under Test.		Pure Bred Bulls.		Average Number Cows in Herds.	Average Production per Cow.		
				Heifers.	Per cent.	Bulls.	Per cent.		Milk.	Test	Butter-fat.
									lb.		lb.
Gippsland ..	45	1,004	32,592	15,166	47	806	81	32·0	5,155	5·02	261·0
Western ..	33	734	26,559	11,227	42	556	76	36·2	4,874	4·62	225·0
North-Eastern ..	15	285	10,803	4,505	42	240	84	39·0	4,725	4·78	226·0
Goulburn Valley ..	14	337	10,574	5,208	49	272	81	31·4	5,544	4·64	258·0
Totals ..	107	2,350	80,528	36,106	45	1,874	81	34·3	5,076	4·80	244·0
DATA OF PREVIOUS YEARS.											
1935–36.. ..	108	2,416	80,817	37,817	47·0	1,946	81·0	33·0	4,934	4·7	233·0
1934–35.. ..	113	2,446	79,701	36,116	45·3	1,991	81·4	32·6	5,309	4·59	244·0
1933–34.. ..	134	2,910	92,953	43,394	46·0	2,214	76·0	31·7	4,723	4·51	212·0
1932–33.. ..	141	3,383	104,009	46,392	44·6	2,619	77·0	31·0	5,290	4·55	241·1
1931–32.. ..	130	3,098	89,619	36,946	41·3	2,323	75·6	29·0	5,393	4·58	247·3
1930–31.. ..	132	3,085	90,360	32,867	36·4	2,251	73·0	29·0	5,383	4·30	234·0
1929–30.. ..	116	2,604	76,032	24,439	32·1	1,653	71·0	29·0	4,944	4·59	226·1
1928–29.. ..	96	2,229	63,277	19,246	30·4	1,354	64·0	30·0	5,080	4·38	223·3

During the year several field days were organized by Association Committees, and there is no doubt that this is the most effective form of education that can be suggested.

PURE BRED BULLS IN USE.

—	Jersey.	Ayrshire.	Friesian.	Guernsey.	Red Poll.	A.I.S. and Shorthorns.
1932–3 ..	74·4	10·3	4·4	1·3	3·6	6·0
1936–7 ..	79·0	8·0	3·0	2·5	3·0	4·5

Leading Herds.

During the past year 355 herds had yields of more than 300 lb. butter-fat. Of this number 75 exceeded 350 lb., twelve of them having records of more than 400 lb. The "high" herd of the year was owned by Mr. J. McLeod, of Bunyip. His ten cows gave the splendid average of 466 lb. butter-fat. Mr. J. D. Pierce, of Rochester, followed closely with 22 cows that led in the 21 to 40 cow section, with an average of 437 lb., a record that was but 17 lb. above that of the 26 cows owned by Mr. H. Sharples, of Jindivick-Neerim. This very consistent herd has exceeded 387 lb. butter-fat in each of the last four years.

Despite the very bad autumn at Beeac, Mr. W. Norman's 24 cows averaged 413 lb. A contributing factor to this fine yield was the 150 tons of first-cut lucerne which is ensiled in a pit. Mr. R. G. Anderson's herd of 38 cows, and the 34 cows of Messrs. Evison and Batema, of Warragul, each exceeded the 400-lb. level of butter-fat production. Mr. J. Bullingham's Tongala herd of 27 Grade Friesians, and Mr. D. McRae's 33 Grade Jerseys, at Wonthaggi, were also very close up to the 400-lb. level. In this section there are 24 herds which surpassed the 363-lb. mark. They include some of the most consistently high-producing herds of the State. Nineteen herds in the under twenty cow section had particularly high yields, including those of Messrs. A. Ross, of Stony Creek, G. Stanlake, of Loch, Mrs. W. B. Watt, of Leongatha, Roy Brothers, of Boolarra, and Unthank and Son, of Mornington Peninsula. Each of these herds averaged more than 400 lb. butter-fat.

A perusal of the lists indicates that it is not a matter of area or rainfall that gives such a high production ranking to these herds; rather, is it a combination of many factors, chief of which are good cows and good management.

Portion of Mr. J. G. Howell's herd at Leongatha.

HIGH-PRODUCING HERDS OF LESS THAN 20 COWS.
(In Order of Merit.)

Owner.	Association.	No. of Cows.	Butter-fat.
			lb.
J. McLeod ..	Bunyip ..	10	466
T. S Powell ..	Swanpool ..	12	421
A. Ross	Stony Creek ..	18	416
G. Stanlake ..	Loch	18	411
Mrs. W. B. Watt ..	Leongatha ..	13	406
Unthank and Son ..	Peninsula ..	16	402
Roy Bros. ..	Boolarra ..	15	400
C. M. Peel ..	Winchelsea ..	11	397
A. J. Morton ..	Kerang ..	17	396
A. J. Mathey ..	Geelong ..	18	395
S. E. Paynter ..	Rochester ..	18	386
R. Lukins ..	Tallangatta ..	17	384
J. Wilson ..	Toora-Welshpool	19	380
Geo. Bright ..	Dumbalk ..	17	380
K. Daffy	Nalangil ..	13	377
J. A. Archibald ..	Rochester ..	10	377
R. W. Smith ..	Swan Hill ..	12	372
F Butler	Swan Hill ..	12	365
W. J. Hinds ..	Leongatha ..	18	364
M. J. Dickson ..	Undera ..	15	364
T. Meaklim ..	Undera ..	14	364

In the section for 41 to 60 cows, Mr. S. Esler's herd of 41 cows, at Undera, has the remarkable average of 407 lb. butter-fat. The majority of Mr. Esler's cows are by bulls from Standard Test herds. Messrs. Keele and Son, of Rochester, have greatly increased their herd size while maintaining a very high yield, their 54 cows averaging 390 lb. The consistent herd of Mr. J. G. Howell, of Leongatha, and that of Mr. E. Colls, of Jindivick-Neerim, both exceeded 370 lb. For the past four years Mr. Howell's herd has averaged 366, 378, 381, and 391 lb. butter-fat respectively, a truly remarkable record when it is remembered that he has more than 40 cows under test. Twenty herds in this section exceeded 317 lb. butter-fat.

Messrs. Walker Brothers, of Yinnar Association, again led in the 61 to 80 cow section, with 328 lb. butter-fat for a herd of 64 cows. Messrs. Batten and Sons, of Warrnambool, had 80 cows, which averaged 321 lb.—another great

Mr. J. A. Shaw's "Uno"—second highest producer for the year with 668 lb. butter-fat.

herd—while other large herds in those of Messrs. J. Little and K. Stockel, of Maffra, averaged 319 lb. Messrs. Hamilton Brothers, of Dumbalk, Kelliher Brothers, of Jindivick, and Clyne Brothers, of Maffra, all had large herds which exceeded the 300-lb. mark.

For all-round efficiency, there is surely no better herd than that of Mr. J. Coolahan, of The Sisters Association. His 98 cows averaged 314 lb. butter-fat. Messrs. E. and J. Harney, of Warrnambool, also exceeded the 300-lb. mark with their 84 cow herd, while Messrs. W. J. Wheeldon, of Warragul (102 cows, 293 lb.), and MacKinnon (95 cows, 297 lb.) each recorded splendid figures. All of these herds have been prominent in this section for some years past. Five of Messrs. Moore and Co.'s herds appear in this list, their No. 3 herd of 141 cows averaging 265 lb.

Mr. R. G. Anderson's "Possum" 578 lb. butter-fat.

High-producing Herds of From 20 to 40 Cows.

(In Order of Merit.)

Owner.	Association.	No. of Cows.	Butter-fat.
			lb.
J. D. Pierce ..	Rochester ..	22	437
H. Sharples ..	Jindivick-Neerim	26	420
W. D. Norman ..	Becac ..	24	413
R. G. Anderson ..	Rochester ..	38	409
Evison and Batema	Warragul ..	34	401
J. S. Bullingham ..	Tongala ..	27	397
D. McRae ..	Wonthaggi ..	33	391
F. Johnson ..	Winchelsea ..	23	387
Rawlinson Bros ..	Werribee South	29	386
K. B. Gunn ..	Leongatha ..	30	384
Wm. Pratt ..	Mountain View	31	383
E. J. Vagg ..	Leongatha ..	20	380
C. J. Pierce ..	Rochester ..	24	379
D. Ussher	Stanhope ..	25	378
W. Wade ..	Maffra ..	33	378
W. Riley	Narracan ..	30	374
J. Beattie	Dumbalk ..	38	373
P. Hickey ..	Cobden ..	24	372
Charlton Bros. ..	Stony Creek ..	37	371
J. A. Shaw ..	Swan Hill ..	38	371
T. W. Truscott ..	Toora-Welshpool	29	371
C. N. Miles ..	Pyramid Hill ..	31	367
T. M. Noble ..	Maffra ..	22	366
J. R. Trump ..	Korumburra ..	32	365
D. K. MacKenzie ..	Fish Creek ..	31	364
T. Evans	Rochester ..	20	364
Collins and Couling	Yinnar ..	25	364

High-producing Herds of From 41 to 60 Cows.

(In Order of Merit.)

Owner.	Association.	No. of Cows.	Butter-fat.
			lb.
S. Esler	Undera ..	41	407
Keele and Son ..	Rochester ..	54	390
E. Colls	Jindivick-Neerim	41	378
J. G. Howell ..	Leongatha ..	47	371
G. and C. Terrier ..	Winchelsea ..	44	353
L. T. Jones ..	Dumbalk North	50	350
H. Furphy ..	Dumbalk North	48	350
R. C. Buchanan ..	Tallangatta ..	60	337
G. R. Charlton ..	Stony Creek ..	42	336
L. A. Peace ..	Leitchville ..	48	335
G. C. Black ..	Casterton ..	50	330
E. J. Sawyer ..	The Sisters ..	47	325
W. G. Farquharson	Winchelsea ..	45	323
J. B. Watson ..	North Sheppar-ton	41	323
C. Maud	Cohuna ..	46	322
T. V. Moore ..	Pomborneit ..	42	322
A. Barr	Winchelsea ..	45	320
J. B. Fuller ..	Dumbalk North	56	317
E. B. Neave ..	Traralgon ..	46	317
H. J. Axford ..	Kongwak ..	60	317

It is interesting to note that the owners of some of the herds in this section, like Mr. A. J. Ford, of Kiewa Valley, have greatly increased the size of their herds in recent years. This constitutes a tribute to the managerial ability of the owners, for in each case the farm's total butter-fat yield has been greatly developed, while the average butter-fat level per cow has remained high.

HIGH-PRODUCING HERDS OF FROM 61 TO 80 COWS.

(In Order of Merit.)

Owner.	Association.	No. of Cows.	Butter-fat.
			lb.
Walker Bros. ..	Yinnar ..	64	328
Batten and Sons ..	Warrnambool ..	80	321
J. Little	Maffra ..	75	319
K. Stockel ..	Maffra ..	72	319
Hamilton Bros. ..	Dumbalk North	63	311
E. Cunningham ..	Werribee South	66	304
Clyne Bros., No. 2..	Maffra ..	68	303
Kelliher Bros. ..	Jindivick-Neerim	77	303
Clyne Bros. ..	Maffra ..	64	300
Clyne Bros., No. 3..	Maffra ..	70	297
P. J. Nichol ..	Tallangatta ..	65	293
Sobey Bros. ..	Ballarat ..	66	293
N. McKinnon ..	Warrnambool ..	78	285
J. McKinnon ..	Ecklin ..	75	285
Holloway Bros. ..	Korumburra ..	61	283
J. Mitchell ..	Tallangatta ..	72	283
Evans Bros. ..	Gellibrand Valley	69	279
J. Dodd and B. Trease	Dumbalk North	68	278
H. G. Noble ..	Maffra ..	75	277
G. S. A. Clyne ..	Maffra ..	75	273
F. J. Webster ..	Maffra ..	78	272
E. Larks	Gainsborough ..	64	272
T. Farrant ..	Cohuna ..	69	269
W. Clement ..	Maffra ..	74	269

Mr. W. Norman's "Sprinnie", 580 lb. butter-fat.

Mr. R. G. Anderson's "Mary", 618 lb. butter-fat.

The Leading Cows.

Prior to the introduction of herd testing work, such terms as "peak" years and "lean" years of production were little used and little understood. It is now quite generally appreciated, that a good cow may make the highest yield of her life, in a special year, when all factors are in her favour, just as horses and men, also, make records when the weather is good, and track conditions are favorable. If a cow

HIGH-PRODUCING HERDS OF MORE THAN 80 COWS.

(In Order of Merit.)

Owner.	Association.	No. of Cows.	Butter-fat.
			lb.
J. Coolahan ..	The Sisters ..	98	314
E. and L. Harney ..	Warrnambool ..	84	306
Macknamara Bros. ..	Werribee ..	95	297
W. J. Wheeldon ..	Warragul ..	102	293
J. Moore and Co., No. 2	Yarram ..	102	285
Clark Bros. ..	Warrnambool ..	92	281
J. Moore and Co., No. 7	Yarram ..	125	276
E. Wright ..	Woodford ..	91	273
C. Glennen ..	Noorat ..	91	270
Kinsella Bros. ..	Lang Lang ..	90	268
J. Moore and Co., No. 3	Yarram ..	141	265
J. Moore and Co., No. 1	Yarram ..	97	256
W. Bourke ..	Warrnambool ..	90	254
O. Shaw	Camperdown ..	81	254
G. Nixon	Eskdale ..	82	251
F. Lester	Leongatha ..	119	248
R. Mitchell ..	Paschendale ..	81	243
J. A. Ford ..	Kiewa Valley ..	85	240
Major Bros. ..	Cohuna ..	81	238
W. Murnane ..	Noorat ..	92	237
J. Moore and Co., No. 4	Yarram ..	91	237

Associations Grouped According to Area and Production.

Western Area.

Unit or Association.	Number of Herds.	Number of Cows.	Average Yield Butter-fat.	Percentage of Heifers.	Number of Bulls.
			lb.		
Ballarat	15	325	265	41	15
Condah	21	595	263	38	19
Gellibrand Valley ..	27	754	259	37	20
Winchelsea No. 1 ..	26	887	258	41	14
Warrnambool ..	18	967	257	42	30
Cobden	26	1,040	253	37	13
Camperdown ..	23	764	253	36	19
Apollo Bay	26	728	250	43	16
Nalangil No. 1 ..	26	1,005	240	34	21
Bacchus Marsh ..	22	661	236	52	17
Woodford	20	1,170	231	42	17
Dreeite South ..	27	975	231	50	25
Pomborneit ..	23	1,011	229	39	15
Nalangil No. 2 ..	24	945	229	41	18
Becac No. 1 ..	26	944	229	48	17
Ecklin	25	891	228	51	18
The Sisters	25	1,111	226	38	21
Noorat No. 1 ..	22	1,405	225	39	25
Winchelsea No. 3 ..	29	554	224	47	10
Ondit-Irrewarra ..	24	902	222	49	14
Winchelsea No. 2 ..	28	688	222	42	16
South Purrumbete ..	17	814	222	35	7
South Glenelg ..	17	317	221	40	11
Mortlake	19	710	219	49	7
Casterton	26	888	218	44	20
Geelong	25	612	218	43	20
Portland	16	542	214	32	9
Keayang	4	450	210	28	11
Port Campbell ..	27	516	209	77	18
Paschendale No. 1 ..	24	891	200	38	13
Becac No. 2 ..	22	722	197	36	12
Paschendale No. 2 ..	14	1,011	184	44	36
Coleraine No. 1 ..	20	766	178	33	12

Gippsland Area.

Unit or Association.	Number of Herds.	Number of Cows.	Average Yield Butter-fat.	Percentage of Heifers.	Number of Bulls.
			lb.		
Yinnar No. 1 ..	24	633	299	44	22
Jindivick-Neerim No. 2	23	572	292	41	15
Maffra No. 1 ..	26	1,143	289	58	29
Toora-Welshpool ..	26	816	288	40	14
Dumbalk North ..	26	1,084	287	36	26
Stony Creek ..	21	544	283	39	14
Jindivick-Neerim No. 1	23	611	275	46	25
Mountain View ..	26	756	274	50	14
Leongatha No. 1 ..	12	393	272	46	8
Loch	24	712	270	54	20
Kongwak	26	998	268	33	20
Narracan No. 2 ..	16	359	267	48	17
Dumbalk	14	425	264	66	14
Bunyip	27	689	261	54	21
Wonthaggi	25	794	257	51	22
Leongatha No. 2 ..	25	976	256	53	20
Gainsborough ..	14	473	255	37	10
Maffra No. 3 ..	23	963	255	55	19
Warragul No. 2 ..	26	806	254	51	18
Leongatha No. 3 ..	30	850	252	39	20
Narracan No. 1 ..	24	536	251	44	21
Fish Creek No. 1 ..	26	730	248	40	11
Yarram	23	1,181	248	43	33
Warragul No. 1 ..	26	841	247	42	15
Pakenham	26	746	247	54	28
Maffra No. 4 ..	24	1,072	245	50	18
Yinnar No. 3 ..	20	554	244	38	14
Korumburra No. 1 ..	27	1,000	243	49	22
Peninsula	24	459	242	57	14
Korumburra No. 2 ..	25	889	242	55	18
Sale	19	649	241	49	18
Mirboo North ..	26	711	239	46	17
Traralgon No. 1 ..	22	889	236	49	26
Foster	28	721	235	30	24
Lang Lang	27	888	235	51	25
Yinnar No. 2 ..	20	471	234	42	20
Poowong No. 1 ..	14	504	233	51	10
Korumburra No. 3 ..	28	925	231	41	19
Traralgon No. 2 ..	22	890	231	48	25
Bairnsdale	8	157	221	34	5
Boolarra	23	766	220	50	17
Poowong No. 2 ..	14	578	216	45	11
Warragul No. 3 ..	24	743	208	46	10
Orbost	21	841	182	43	15
Maffra No. 2 ..	6	254	176	47	2

is past her junior years, and calves in high condition, in a year when there is a "Spring in the Autumn," she may milk exceedingly well. This is particularly likely, if she has had a long pre-calving rest, and is withheld from service for several months after calving. All these factors make for a "peak year," and a yield which may be particularly high, with a really good producer. Conversely, it is also true, that a really good cow may yield far below her normal ability, should the reverse of these conditions be encountered.

Mr. G. Black's "Connie" 516 lb. butter-fat.

Remembering these possibilities, the splendid performances of cows like "Nellie Bly" (six year's average, 536 lb. butter-fat; and 605, 609, and 642 lb. in each of the past three years)

1. Messrs. F. Unthank Son's "Jersey Hill Polly 3rd", 592 lb. butter-fat; 2. Mr. S. Pratt's "Pet" 506 lb. butter-fat; 3. Mr. C. H. Miles' "Silvy", 358 lb. butter-fat as a Junior two-year-old; 4. "Daphne", owned by Mr. J. B. Watson, 506 lb. butter-fat; 5. Mr. D. McRae's "Grace" 560 lb. as a three-year-old.

ASSOCIATIONS GROUPED ACCORDING TO AREA AND PRODUCTION.—*continued.*

North-Eastern Area.

Unit or Association.	Number of Herds.	Number of Cows.	Average Yield Butter-fat.	Percentage of Heifers.	Number of Bulls.
			lb.		
Tallangatta No. 1 ..	19	854	270	36	19
Eskdale No. 1 ..	14	646	262	37	10
Swanpool No. 2 ..	20	500	258	41	20
Swanpool No. 1 ..	21	594	255	50	19
Eskdale No. 2 ..	13	481	250	28	7
Euroa	23	473	244	42	23
Myrtleford	20	588	243	52	12
Alexandra	21	601	239	44	15
Tallangatta No. 2 ..	19	753	228	35	13
Moyhu	22	713	224	59	17
Upper Murray ..	18	1,005	220	29	14
Kiewa Valley No. 2 ..	23	1,249	218	48	22
Kiewa Valley No. 1 ..	24	1,235	211	40	25
Walwa	10	424	198	42	9
Milewa	18	687	184	37	15

Goulburn Valley Area.

Unit or Association.	Number of Herds.	Number of Cows.	Average Yield Butter-fat.	Percentage of Heifers.	Number of Bulls.
			lb.		
Rochester	26	767	311	54	20
Stanhope No. 1 ..	24	610	287	54	21
Werribee South ..	21	949	281	51	18
Swan Hill	29	675	271	51	25
Undera	23	709	260	52	12
Tongala	26	838	255	45	25
Stanhope No. 2 ..	17	459	249	51	16
Kerang	25	805	247	54	16
Cohuna	24	1,020	246	55	21
North Murchison ..	27	889	245	41	25
North Shepparton ..	22	539	245	51	17
Leitchville	28	1,070	242	44	29
Pyramid	22	575	218	38	18
Calivil	23	669	216	50	10

must be fully appreciated. This cow is owned by Mr. H. Sharples, of Jindivick-Neerim, and is the only cow to appear for three consecutive years, among the "best twenty" grade cows of the State.

The leading cow for the year is Mr. S. Esler's "Lulu," which returned 686 lb. butter-fat in the 273 days test. She also appeared in last year's list with a yield of 610 lb. Her herd-mate, "Pearl," is third on this occasion, with

647 lb. butter-fat. These two cows, like the majority of Mr. Esler's herd, were sired by "Lassie Fowler's Twylish of Rosemont." A feature of this bull's daughters is their high average test.

Mr. K. Stockel's "Phylis," with 586 and 611 lb. butter-fat, is another cow that has appeared in this list for the past two years, as has also Mr. R. G. Anderson's "Possum." The latter's yields were 568 and 579 lb. respectively. This cow was bred in the herd of Messrs. H. E. Keele and Son, her sire being "Goulburn Twylish 2nd." Her herd mate, "Mary" occupies sixth place with 11,567 lb. milk and 618 lb. butter-fat. "Mary" is a Shorthorn-Ayrshire grade, and has three prior records of more than 540 lb.

Mr. J. A. Shaw's "Uno," with 668 lb., is yet another instance of a great producer that was sired by a bull bred from a Standard Herd Test cow. She was tested at Swan Hill.

Mr. J. McLeod's "Trixie 2nd" is a very remarkable "second calver," as is shown by her yield of 636 lb. butter-fat. She is a member of the Bunyip herd which headed the herd averages with 466 lb. butter-fat. A registered Red Poll, owned by Mr. G. A. Evans, of Swanpool, has the good record of 583 lb. This yield gained her a place in the select company of the State's best producers.

Messrs. P. Hickey, of Cobden, and Geo. Black, of Casterton, each own a high testing cow that exceeded 600 lb. butter-fat. Mr. J. D. Pierce's "Myrtle 2nd" is but one of the many fine producers sired by "Bossoon of Mayfield Park." Thirteen of his mature daughters averaged 469 lb., while four three-year-olds averaged 431 lb. butter-fat. All the leading animals of this herd were tattooed under the V.U.C.T.A., Marked Calf Scheme.

"Bingo 2nd," owned by Mr. J. Bullingham, was the highest milk yielder of the year with 15,396 lb.; her half-sister, "Midge 2nd," was close up with 14,696 lb. Each of these cows exceeded 560 lb. butter-fat. From Warrnambool comes Mr. W. Watson's "Reene," with a similar yield of butter-fat from 13,454 lb. milk.

Of the 80,528 tested cows 16,128 (or 20 per cent.) exceeded the 300 lb. butter-fat level, and of this number 1,795 yielded over 400 lb., while 156 others passed the 500-lb. mark, including nine with records of more than 600 lb.

A perusal of the list of the "best twenty producers" brings out the fact that these cows generally combine high yield with high test,

LEADING COWS.

(See plate on opposite page.)

1. *Mr. J. A. McKinnon's "Joyce", 516 lb. butter-fat.* 2. *Mr. J. McKean's "Butter up", 581 lb. butter-fat.* 3. *"Flighty 2nd", a three-year-old Jersey owned by Mr. J. Bennett, 422 lb. butter-fat.* 4. *Messrs. H. E. Keele and Son's "Jenny 3rd", 509 lb. butter-fat.* 5. *Mr. C. H. Miles' "Darling", 400 lb. butter-fat as a senior two-year-old.* 6. *"Admiration", also owned by Mr. C. H. Miles, 547 lb. butter-fat.* 7. *Messrs. Silcock Bros. "Bubs", which yielded 597 and 518 lb. butter-fat in successive years.* 8. *Mr. J. A. McKinnon's "Grace", 502 lb. butter-fat.* 9. *"Fairy", 419 lb. butter-fat (Mr. J. A. McKinnon).* 10. *"Eelendale Romany 4th", a three-year-old Jersey owned by Mr. J. Bennett, 412 lb. butter-fat.* 11. *Mr. A. C. Morley's "Flossy", 537 lb. butter-fat.* 12. *Mr. S. Pratt's "Roby", 576 lb. butter-fat.* 13. *"Brownlock" (deceased), average yield 432 lb. butter-fat and 11 calves in nine years.*

List of Twelve Leading Three-year-olds.

Owner.	Association.	Name of Cow.	Milk	Butter-fat.
			lb.	lb.
J. McLeod	Bunyip	Trixie 2nd	10,945	636
D. McRae	Wonthaggi	Grace	11,060	560
J. McLeod	Bunyip	Cherry 2nd	10,406	553
J. McLeod	Bunyip	Dolly 2nd	9,501	545
O. Leemon	Wonthaggi	Violet	9,783	519
H. W. Waterhouse	Pakenham	Mornmoot Madge 2nd	8,519	517
J. G. Howell	Leongatha	Trixie	9,411	516
M. O. Bunn	Korumburra	Glenhope Slywinks	8,459	514
E. Gadd	Traralgon	Lucy	10,321	511
Keele and Son	Rochester	Jenny 3rd	8,409	508
Rawlinson Bros.	Werribee	Gladys	10,892	506
J. A. Shaw	Swan Hill	Splinter	10,823	497

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TWENTY LEADING COWS, WITH DETAILS OF OWNERSHIP, IDENTIFICATION, PRODUCTION AND BREED OF SIRE, ETC.

Owner.	Association.	Name of Cow.	Brand.	Milk.	Test.	Butter-fat	Sire.
				lb.	%	lb.	
S. Esler ..	Undera ..	Lulu ..	T:17 12	10,669	6·23	686	Lassie Fowler's Twylish of Rosemont
J. A. Shaw ..	Swan Hill ..	Uno ..	S:21 32	11,619	5·74	668	Beverley Imperial
S. Esler ..	Undera ..	Pearl ..	T:17 32	10,381	6·29	647	Lassie Fowler's Twylish of Rosemont
H. Sharples ..	Jindivick-Neerim	Nellie Bly	J:42 29	10,849	5·91	642	Grade Jersey
J. McLeod ..	Bunyip ..	Trixie 2nd	P:3 20	10,945	5·83	636	Grade Jersey
R. G. Anderson ..	Rochester ..	Mary ..	ER:50	11,567	5·3	618	Shorthorn
P. Hickey ..	Cobden ..	Amy ..	C:38 21	9,831	6·2	614	Unknown
G. C. Black ..	Casterton ..	Primrose ..	JR:4 56	9,612	6·28	604	Registered Jersey
Mrs. W. B. Watt	Leongatha ..	Patch ..	L:7 20	11,194	5·4	603	Unknown
Silcock Bros. ..	Yinnar ..	Bubs ..	Y.	13,623	4·38	597	Shorthorn
T. Meaklim ..	Undera ..	Jean ..	UD:9 4	11,565	5·14	595	Unknown
F. Unthank and Son	Peninsula ..	Jersey Hill Polly 3rd	REGST'D	10,819	5·4	592	Roseland's Star of Brookfield
K. Stockel ..	Maffra ..	Phylis ..	CV:24 14	10,649	5·52	586	Jersey
A. G. Evans ..	Swanpool ..	Wincey ..	REGST'D RED POLL	11,615	5·02	583	Dinkum Astrologer
W. J. McKean ..	Cobden ..	Buttercup	C:22 39	10,530	5·5	581	Unknown
E. Gadd ..	Traralgon ..	Molly ..	E:61 28	10,024	5·78	580	Registered Jersey
W. D. Norman ..	Beeac ..	Sprinnie ..	EK:2 25	11,826	4·9	580	Registered Jersey
G. P. Geake ..	Stony Creek	Bonnie ..	B:72 24	8,414	6·86	579	Unknown
R. G. Anderson ..	Rochester ..	Possum ..	ER:50 16	9,596	6·00	579	Goulburn Twylish 2nd
J. D. Pierce ..	Rochester ..	Myrtle 2nd	R:13 9	11,898	4·80	577	Bossoon of Mayfield Park

two features that rarely occur in the make-up of any one of the breeds of dairy cattle.

The average test of the mass of recorded cows still shows a slight increase. Doubtless this is due to the ever-increasing percentage of Jersey and Guernsey bulls being used in the herds under test.

Herd Testing and Production Costs.

A question frequently asked is whether herd-recording work has any beneficial influence on the cost of producing 1 lb. of butter-fat. The logical answer to this question is, that if there is no favorable influence much time and money are being wasted in 34 dairying countries of the world, where upwards of 4,500,000 dairy cows are being regularly and systematically herd tested. Actually there can be no doubt about the influence of the scales and tester, when applied rationally to the development of the dairy herd, and of the influence of testing on the economic production of butter-fat. Butter-fat can be produced economically only if the all too-common error of over-capitalization has been avoided, and rational farm management is being practised.

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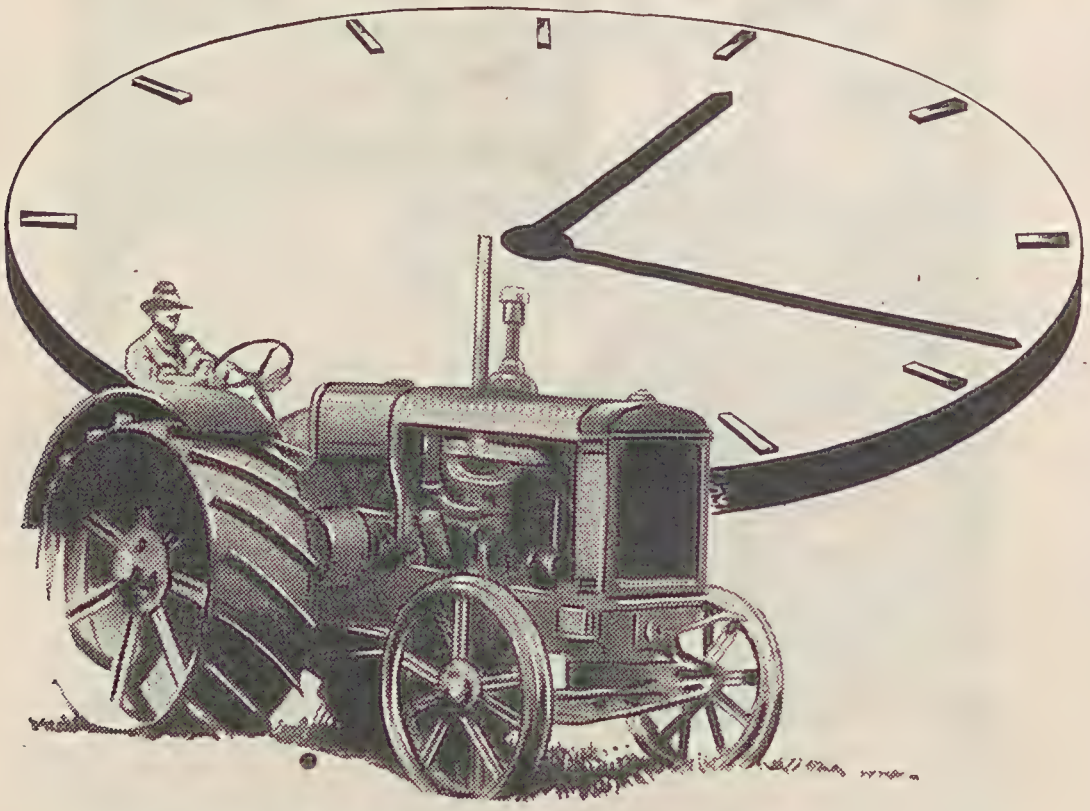

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The dairy farmer is committed to certain annual costs in the management of his farm, some of which are definite costs and, therefore, cannot be avoided. If he is purchasing, leasing, or renting a farm, he must find the rent, or interest and principal, and he must look to his dairy cows as the earning units to provide this money. Farm running costs, or maintenance, must also be found before he can pay himself a salary, or labour reward. On some farms, pigs, calves, and poultry are exploited to utilize the skim milk, which becomes an indirect source of revenue.

Unfortunately, some dairy-farmers lack a sound knowledge of dairy farming; they know little of the factors that influence the cost of producing a pound of butter-fat; or, if they do know them there are times when they ignore them, apparently believing that better pastures, top-dressing, better bulls, herd-testing and culling the herd on known producing ability are "frills" that are too costly to be utilized. They accept the principle that more cows on the farm must mean more profit, quite overlooking the fact that this is the case only when more feed is available. Over-stocking is the most serious form of under-feeding, since every cow in the herd is prevented from making her normal production. Under such conditions, the bulk of the feed is used to maintain the cows, and insufficient is available for the purpose of milk-making.

Portion of Mr. J. D. Pierce's herd of 22 cows which averaged 437 lb. butter-fat.

Mr. J. B. Watson's "Nellie" 528 lb. butter-fat.

If a dairy-farmer can increase the number of cows carried on his farm without lowering the average yield of butter-fat, this must react favorably on the production cost of each pound of butter-fat, since the overhead cost per cow must be lowered. If, at the same time, the yields of the cows can be increased, the reduction in costs must be even greater.

The main factors which affect herd improvement are definitely those of more and better feeding, culling the low producers, and breeding higher producing stock. Other factors are

List of Twelve Leading Two-year-olds.

Owner.	Association.	Name of Cow.	Milk.	Butter-fat.
			lb.	lb.
D. K. McKenzie	Fish Creek	Stella	9,149	502
W. Semple	Rochester	Lady	7,470	494
M. O. Bunn	Korumburra	M. Dairywinks	7,760	487
D. Ussher	Stanhope	Mist	8,871	477
S. Esler	Undera	Dainty	8,099	475
D. Ussher	Stanhope	Gee Whiz	9,365	473
E. Gadd	Traralgon	Cocky	8,280	468
D. McRae	Wonthaggi	Ginger	8,040	468
K. Gunn	Leongatha	Sadie	9,255	455
K. Stockel	Maffra	Sooty	9,282	455
E. J. Vagg	Leongatha	Rydon May Queen 2nd	8,188	448
J. A. Witheran	Myrtleford	Princess	7,711	443

rugging cows in cold weather, easy access to water, shade, and shelter; also quiet, regular milking, and sound feeding practices.

While it is true that dairy cows will respond up to their maximum milk yield capacity, when they are fed and managed rationally, every herd-testing dairy-farmer knows how great may be the differences in the yields of his cows when all conditions are equal. There can be only one main reason why dairy cows, normal in every other respect, exhibit wide variations of production, and particularly why some individuals fall so far below the average yield of the herd—that is the fact that they have not inherited the ability to produce as much butter-fat as other cows from a given quantity of feed.

Herd records are but a measure of the producing ability of each cow, and it is for the farmer to interpret those records. In making his comparisons, he should make reasonable allowance for age, dry period prior to calving, length of time before service, period of year when calving, sickness and accident, or any other real cause of disability. When all these features are considered, it will be found that cows still fall into definite groups, viz.:—

Approximate 160 lb. butter-fat, or State average cow;
Approximate 200 lb. butter-fat, or the dairy area average cow;
Approximate 240 lb. butter-fat, or the herd test average cow;
And cows that exceed 300 lb. butter-fat. There are upwards of 20,000 of these "300 lb. or better" cows in the herd test movement.

The average dairy-farmer has a capital cost of approximately £100 per cow, while the cost of maintaining the farm usually exceeds £2 per cow per annum. These costs must be met before money is available for labour reward. The effect of yields on the cost of interest, labour, and farm maintenance is set out in the accompanying table, which allows £150 a year as wages, £3 a cow for farm running expenses, and interest at 5 per cent. on capital cost. In this example it is presumed that one male unit of labour can handle efficiently fifteen dairy cows and do all the farm work necessary for that number of cows.

It will be seen that, with butter-fat at 13d. per lb. (the average price during the past two years) the 300 lb. butter-fat cow can pay all charges, provided allowance be made for the value of skim milk fed to calves, pigs, or poultry—estimated at approximately 2d. per pound of the butter-fat yield.

TABLE—SHOWING THE ANNUAL COST PER COW, AND PER POUND OF BUTTER-FAT, WHEN THE PRICE IS 13D. PER POUND (AS IN 1936-37), AND WHEN THE NUMBER OF COWS HANDLED PER MALE UNIT OF LABOUR IS FIFTEEN.

(The effect on the costs with the variation in yields, is shown in these columns.)

Annual Cost per Cow.		Cost per pound of Butter-fat. Average Yield per Cow.			
		160 lb.	200 lb.	250 lb.	300 lb.
	£	*d.*	*d.*	*d.*	*d.*
When interest is 5 per cent. and the capital value is £100 ..	5	7·4	6	5	4
When £150 per annum is the labour reward ..	10	14	11	9	8
When £3 per cow is the annual farm maintenance cost	3	4·2	3·3	3	2·2
Total	18	25·6	20·3	17	14·2

NOTE.—A 300-lb. butter-fat cow pays all costs when the price is 13d. a lb. and skim milk is valued at 2d. per lb.

The amount of £3 a cow allowed for farm maintenance cost is not too liberal. In this connexion it may be pointed out that in a

Mr. S. Esler's "Pearl" third highest producer for the year with 647 lb. butter-fat.

recent survey of 550 New Zealand dairy farms this item was set down at £4 6s. 6d. per cow. Further reference to the table shows that under these conditions, with a cow averaging 200 lb. butter fat, interest will cost 6d. a lb.; labour, 11d. per lb.; and farm maintenance, 3.3d. per lb.; a total of 20.3 per lb. of butter-fat. These cows almost paid their way during the period from 1924 to 1929, when butter-fat prices averaged 1s. 6d. per lb.; but even in 1921–22, when butter-fat was bringing as much as 2s. 4d. a lb., the 160-lb. cow gave very little profit over the above costs. The position of the owner with this class of cow at the present price of butter-fat can well be imagined.

Mr. M. M. Clark's "Maxon Count's Favourite", 538 lb. butter-fat.

If by better management of pastures and conservation of fodder the carrying capacity of the farm can be doubled, as is sometimes done, the interest cost is halved; if at the same time the herd average can be raised from 160 lb. to 250 or 300 lb. butter-fat per cow, the difference between hopeless slavery and a satisfactory living is obtained. Herd-recording work indicates the weak links of the farm practice. The figures in the table show the charges which must be levied against each cow according to her production, and indicate clearly that the overhead cost both per cow and per 1lb. of butter-fat, can best be decreased by breeding better dairy cows, and by carrying more of those cows on a given area.

During the early years of herd-testing work, the 300-lb. butter-fat herds were few and far between, but in recent years approximately 20 per cent. of all herds under test in Victoria have reached or exceeded that level. Much of the credit for this achievement is due to the herd-recording movement.

Tubercle Free Herds

The following herds have been declared free of tuberculosis under the scheme conducted by the Department of Agriculture. Under this scheme a tuberculosis-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests, or, upon disclosure of infection, three semi-annual, successive physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

ACCREDITED TUBERCLE FREE HERDS.

Herd Number.	Name.	Address.	Number in Herd.	Herd Number.	Name.	Address.	Number in Herd.
1	State Research Farm	Werribee ..	259	7	Mailer, Dr. Ramsay ..	"Maneroo," Shepparton	92
2	Warragul High School	Warragul ..	35				
3	Payne, A. E. T. ..	"Yarra View," Lilydale	80	8	Reid, Ralph G. ..	"Holmwood," Koo-wee-rup	99
4	Dennis, Mrs. A. A. ..	Frankston ..	14	9	Harris, J. W. ..	"Rowena," Clyde	72
5	Slaney, H. B. ..	Mornington ..	85				
6	Lady Talbot Milk Supply Company	Cranbourne ..	418	10	School of Horticulture	Burnley	8

The Cultivation of Flax for Fibre

Renewed efforts are being made to stabilize the Flax Industry in Victoria and the area of more than 1,100 acres sown in 1937 is the largest that has been under flax for some years. Improved varieties have been imported, and the Department of Agriculture has undertaken experimental work to investigate and encourage flax growing in those districts where it should prove profitable to the grower. The bulk of the crop sown this year is being grown under contract at £5 per ton for the "undeseeded" crop, a price at which flax growing is attracting the attention of farmers. The following information is provided for their guidance.

THAT flax can be successfully cultivated in Victoria has been demonstrated over a period of many years. Linum flax (*Linum usitatissimum,* as distinct from the New Zealand "flax"—*Phormium tenax*) may be grown for the seed borne by the plant (known as linseed) or for the fibre contained in the stem; but in Victoria, while the seed harvested is of considerable value, fibre production is the main consideration.

In some parts of Europe and Northern Ireland, farmers process their own flax, but here growers must rely entirely on flax mills to purchase their straw and undertake all the operations of deseeding, retting, and scutching that are required to produce the finished fibre. **Farmers, therefore, should consider flax growing only when they can make satisfactory arrangements to dispose of their crop to a flax mill.**

Climate and Soils.

For the production of fine long fibre, the flax plant requires a district with a cool, moist spring, and with an annual rainfall of 25 inches or more well distributed through the growing season. Flax will not withstand droughty conditions, and areas subject to long dry spells after the time for sowing should be avoided. Straw from such districts probably would be shorter than the standard length of 27 inches required by the mills.

Flax thrives on well-drained free loamy soils, but is not suited to heavy clay loams nor to sandy soils. In Victoria, flax has been grown with success in the vicinity of Drouin, Warragul, Leongatha, Traralgon, Colac, Ballarat, Hamilton, and in the North-East.

Rotation.

If flax is grown continuously on the same ground for a number of years, the land tends to become "flax sick." This is not due, as is sometimes thought, to the exhaustion of the soil by the flax, but to the presence of a disease known as "Flax Wilt," caused by a fungus, *Fusarium lini,* the spores of which remain in the ground and attack the roots. Thus, while flax may give two profitable crops when sown in successive years on the same land, it is preferable not to plant flax on the same land more often than once every four or five years, so that the danger of flax wilt is minimized.

Preparation of the Seed Bed.

Land intended for flax should be ploughed as early as possible, and then worked down into a fine tilth to ensure a favorable environment for the small seed and young seedling. Weedy ground is not suitable for flax, and the seed bed should be given as thorough a preparation as possible so that weeds will be practically eliminated before sowing. The seed bed should be reasonably firm to prevent the seed being buried too deeply during sowing, and if the soil is loose, it may even be advisable to roll the land before sowing.

Sowing the Seed.

The seed should be sown at the rate of about 70 lb. per acre, and can be sown through the "fine" side of an ordinary grain drill. While settings for 48 to 60 lb. of dry wheat will give the correct delivery of flax with some drills, the setting will vary considerably, and growers should test their drills for themselves. The drill may be used to broadcast the seed on the surface by removing the delivery tubes from the hoes, but a better distribution will be obtained if the seed is allowed to fall first on to a board set at a slight angle. Unless the seed bed is very loose and there is a danger of the seed being sown too deeply it will be found quite satisfactory to drill the seed in rows through the hoes or discs. Care should be taken, however, to keep the seed as near the surface as

possible—¼ to ½ an inch deep is quite sufficient, and it should not be sown deeper than one inch. Any misses in drilling should be carefully hand sown to make sure that weeds do not develop luxuriantly on what would otherwise be blank spaces. It is advisable to harrow lightly after drilling so that any seed left on the surface will be covered. Where conditions permit, a final rolling will level the ground and allow the binder to work close to the ground and so cut a maximum length of straw. Drilling round and round the paddock rather than in "lands" will also facilitate the work of the binder, which appears to cut better when travelling along the length of the drill rows.

Seed may be sown from mid-April to early-June depending on the district and the season; but unless there is known to be danger of the crop lodging or of weeds being troublesome, the aim should be to sow early.

Weeding.

As the presence of tall-growing weeds reduces the value of flax, it is always advisable and sometimes necessary to go over the crop in the early stages of growth and cut or pull any tall-growing weeds such as thistles, dock, wild turnip, &c. which have survived the cultivations given in preparation of the seed bed, or which may have been sown with the seed.

Varieties.

In the past, the Blue-flowering Riga has been the variety in general use in Victoria, but following the development of pure strains of flax seed in Northern Ireland, the pedigree strain "Liral Crown" was introduced in 1935, and in 1937 practically the whole Victorian acreage was sown with this variety. Liral Crown throws up its stem more quickly than Blue Riga and matures earlier, and for this reason it would appear that it could be sown with safety later in the season than Blue Riga. Trials in Northern Ireland have shown that, compared with the commercial Blue Riga types, pedigree Liral Crown gives a higher yield of straw per acre, a higher percentage of fibre per ton of straw, and the fibre itself is of higher quality. Reports of this variety in Victoria have been most promising.

Fertilizers.

There is no very positive evidence as to the respective merits of the various artificial fertilizers. However, Victorian soils are generally deficient in phosphates, and growers are advised to apply superphosphate at the rate of 1 to 1½ cwt. per acre. Where flax is sown on rich soil after a heavily manured crop of potatoes, there may be a danger of the crop growing too rank and lodging if manure is applied with the flax. In such cases it would be advisable to use smaller dressings or even no manure. Departmental experiments in progress this year under varying conditions of soil and climate will provide more information on the use of fertilizers.

Maturity.

Great importance is attached to the time of harvesting, as the quality of the fibre varies with the degree of ripeness, and when flax is too green when cut, the seed does not mature sufficiently in the stook. The result is a light papery seed which has a low germinating power and which therefore may not be fit for resowing. The time to harvest is when the lower part of the stem, from about one-half to three-quarters of its height, has changed colour from green to yellow and the leaves to this extent have withered and fallen. At this stage an examination of the seeds within the older capsules shows them to be just changing from a full green colour to a brownish tint at the apex of the seed. It should be remembered that flax ripens considerably after it has been pulled or cut, and that the stage of ripeness indicated should not be allowed to pass without the crop being taken.

Methods of Harvesting.

In European countries, the common practice is to pull flax from the ground by hand. Small areas have been harvested by this method in Victoria, but the expense involved is usually too great, and practically all flax here is cut by the reaper and binder. The binder should be set to work as close to the ground as possible, and as flax is rather tougher to cut than oaten hay, the machine should be in good running order. The knives should be plain rather than serrated and kept as sharp as possible. The crop is easier to cut on warm days, and it is not advisable to start cutting until the morning is well advanced. The sheaves should be of medium size, well butted, and tied securely nearer the head than the butt as the twine tends to slip towards the butt. Care should be taken to keep all butts even with the straws within the sheaf parallel to facilitate the extraction

of long fibre at the mill. The sheaves should be arranged in long narrow stooks to encourage rapid maturing, before being carted and stacked.

Experimental Plots.

By arrangement with Flax Fibres Pty. Ltd., who own flax mills at Drouin and Colac, the Department of Agriculture sowed, in 1937, a series of exploratory experimental plots at five centres, viz.: Drouin and Leongatha in Gippsland, Warncoort and Strathkellar in the Western District, and at Newlyn near Ballarat. The investigations include rate of seeding trials; broadcast versus drilling tests; manurial trials with superphosphate in varying quantities and combined with muriate of potash, and with sulphate of ammonia; and variety trials with Blue Riga, Latvian, Giza Purple, and the new pedigree flaxes from Northern Ireland—Liral Crown, Liral Monarch, Liral Dominion, Stormont Gossamer and Stormont Cirrus, and with seed of Liral Crown from different sources, viz.: Norfolk, Egypt, and Victorian grown.

The results from these trials should be a definite guide to growers, and should form a basis for more intensive investigational work into the growth of the flax plant.

Further information can be obtained from the Department of Agriculture, Public Offices, Melbourne, C.2.

Butter Production and Export

The following table shows:—

(*a*) Factory production of butter and cheese in Victoria for the months of July and August, 1937, compared with the corresponding months of 1936; and

(*b*) Quantities and percentages of various grades of bulk butter examined for export in Victoria from 1st July, 1937, to 25th September, 1937, in comparison with the corresponding period of 1936.

FACTORY PRODUCTION OF BUTTER AND CHEESE IN VICTORIA (QUANTITIES IN TONS).

Month.	Butter.		Cheese.	
	1937.	1936.	1937.	1936.
July	2,336	2,430	259	242
August	3,557	3,556	394	372
Totals, 2 months	5,893	5,986	653	614

BULK BUTTER EXAMINED FOR EXPORT IN VICTORIA (QUANTITIES IN TONS).

Period.	1937–38. How Graded—				Total.	Period.	1936–37. How Graded—				Total.
	Ch.	1st.	2nd.	Pty.			Ch.	1st.	2nd.	Pty.	
1st July to 28th August	272	91	60	4	427	1st July to 29th August	787	314	106	17	1,224
29th August to 25th September ..	1859	502	119	4	2484	30th August to 26th September ..	1886	824	159	15	2,884
Totals 1st July to 25th September ..	2131	593	179	8	2911	Totals 1st July to 26th September ..	2673	1138	265	32	4,108
Percentages ..	73·2	20·4	6·1	0·3	..	Percentages ..	65·0	27·7	6·5	0·8	..

Nut Culture and Production in Victoria

By Edward E. Pescott, F.L.S., Senior Horticultural Instructor.

THE climate and soils of Victoria are eminently suited to the growth of nut-bearing trees and to the successful production of all kinds of nuts requiring a temperate climate. The nuts generally grown are the almond, walnut, chestnut, and those belonging to the hazel, filbert, and cob nut group. Peanuts occasionally are grown, and there are a few odd trees of the macadamia nut and the pecan nut.

The following figures taken from the *Victorian Year-Book* illustrate the position regarding nut culture in Victoria in 1934-5:—

Nuts.	No. Trees	Yeild.
Almonds	36,938	94,808 lb.
Chestnuts	867	24,507 „
Filberts, &c.	2,107	1,178 „
Walnuts	10,805	37.928 „

Almond trees (Jose's B.1) Marion, South Australia.

On these figures, it would appear that the nut production of the trees in this State is very low and the industry would seem to be very unprofitable. The above figures, however, include a very large number of young non-bearing trees, as well as trees planted around the boundaries of farms and orchards, which are neither regularly cultivated nor pruned.

The Commonwealth of Australia imports up to about a quarter of a million pounds weight annually, indicating that the planting of nuts may yet be considerably increased. An increase in the consumption of nuts, not only as a direct article of diet, but also for use in confectionery and cooking, appears very probable.

THE ALMOND.

(*Amygdalus communis.*)

The almond originated in the north of Africa and the Orient. It is closely related to the peach, the chief distinction between the two being in the fruit. In the peach the fruit is a rich and delicious flesh, while in the almond the "fruity" portion is merely a thick dry skin, covering the stone.

There is an ornamental flowering variety of the almond raised in Victoria, and grown as *Amygdalus Pollardi.* This tree frequently bears medium-sized, coarse, fleshy, peach-like fruits, with thick-shelled almond nuts.

Almond Districts.

An analysis of almond-growing areas discloses the interesting fact that by far the largest number of almond trees are growing in the northern areas. The Mallee, with the Mildura settlements as a centre, has approximately 20,000 trees; while the northern central districts, which include the Goulburn Valley, Bendigo, and Swan Hill areas, have about 15,000. The Wimmera and the North-East

An almond plantation at Eldorado, Victoria.

have about 10,000 between them; while only a few, comparatively speaking, are grown in the western, metropolitan, and Gippsland districts. Mildura, Quantong, Wangaratta, Eldorado, Swan Hill, and Tresco are our principal almond-growing centres.

The extension, or the success, of almond culture in those areas is due to the fact that the trees suffer far less from fungous diseases, and therefore are more productive than those in wet cold districts.

The almond then succeeds best in a good soil, which is fairly deep, and which is well drained. Considering the difference between the soils, say, of Mildura and Beverford, of Quantong and Wangaratta, it would seem that almost any type of good quality soil is suitable for almond culture; and if drainage be provided, the trees will grow well. Almond trees will flourish even in the dry Mallee, provided they be given a sufficiency of moisture during the growing and the bearing period.

Varieties.

More than 150 varieties of almonds are grown in the United States of America, while approximately 60 varieties are listed in Australian catalogues, more than half of these being cultivated in Victoria. There are over a dozen named Australian seedlings, all of which originated in South Australia; while a dozen or two more seedlings are under observation, also in that State.

Of the imported varieties, Harriott (Commercial), I.X.L., Ne Plus Ultra, Burbank, Nonpareil, Golden State, Sultana, Grosse Tendre, and the Jordan varieties are among the most favoured. Practically all of the Australian varieties, with the exception of Monstrous, are generally grown. In Victoria, Brande's Jordan, Paper Shell, I.X.L., Burbank, and White Nonpareil are more generally grown, with Hatch's Nonpareil, Ne Plus Ultra, and Peerless in fewer numbers.

If the accompanying list of almonds issued by the Marion Branch of the South Australian Fruit Growers' Association, which is the main Almond Growers' Association in South Australia, be studied, it will be noted that of the twelve best almond varieties only two are of the imported types, I.X.L. and Ne Plus Ultra. This list gives the twelve main, and recommended, commercial

A Jordan almond tree in blossom.

Left, Commercial; Right, Golden State.

Note.—All illustrations of nuts and kernels in this article are natural size.

varieties grown on the Adelaide plains, together with the average weight of kernels per lb. of nuts.

Variety.	Average Weight of Kernel per lb. of Nuts.
	oz.
Brandes	5¾
Adam's Brandes	6
B.1 (Jose's)	6
I.X.L.	5¾
Hatch's Nonpareil	11
Chellaston	6½
White Brandes	7¼
Imperial	5¾
Johnson's Prolific	6
Ne Plus Ultra	7¾
Pitman's Brandes	5½
Selgar	7½

There is much confusion in Victoria, as elsewhere over the naming of varieties. Undoubtedly much of this is due to substitution and the mixing of labels during distribution. For instance Harriott, both here and in America, is also wrongly called Commercial. The two varieties are very distinct. This substitution can readily be understood when various types are distributed. Thus there are several Jordan almonds, such as Early Jordan, Rock Jordan, Brande's Jordan, and others. Locally there are several varieties raised by a Mr. Brande, of Enfield, South Australia; and, in addition, others similar to these are given his name. Hence we have Brande's Jordan, Adam's Brandes, "Brandes" White Brandes, Pitkin's Brandes, and so on. The name frequently is incorrectly spelled as "Brandis." Incidentally, it is believed that over 50 per cent. of South Australian almonds are of the Brande's Jordan variety.

Description—Introduced Almonds.

Burbank.—A dark brown nut with a rather hard shell. It has a kernel inferior to Jordan; 191 nuts per lb.; 6.5 oz. of kernel to the pound of nuts; a light cropper; variety of little consequence in America.

Commercial.—Tree upright and vigorous; nut long ovate-oval, broad at base; kernel seldom fills shell cavity, 8 oz. to the pound of nuts, dark brown, 160 to 180 nuts per lb.; crop fair to good.

Eureka.—Tree slow growing; upright and compact; foliage dense; nut rather small, crescent shaped oval, long and narrow; kernel long and narrow, somewhat hook pointed; 220 nuts to the pound, about 6 to 8 oz. of kernel; good crops.

Golden State.—Tree spreading upright, vigorous, dense foliage; shell medium brown, not always soft, somewhat squat, medium size; wing extends down dorsal side; kernel pointed, sharply curved at shoulder; wrinkles when dry; several doubles; 154 nuts to the pound, 4 oz. of kernel; fair cropper.

Grosse Tendre.—Tree spreading, straggly, willowy; foliage fairly dense; somewhat alternate bearer; nut medium to large; very wide ovate

Top left, Grosse Tendre; Top right, Harriott; and lower, two kernels of Grosse Tendre.

in shape, curve very clear cut, dark brown, medium in hardness; kernel, doubles numerous, large flat, often mistaken for I.X.L., 143 nuts per lb., 6·3 oz. of kernel; light cropper.

Harriott.—(Not Commercial.) Tree large, moderately upright, vigorous; foliage dense; nut rather large, long narrow ovate, plump, somewhat scimitar shaped, both apex and base tapering; shell soft, light yellowish brown; kernel, creases on one side as tending to doubles, but doubles seldom develop, size large, widest at middle, flat; nuts 140 per lb., 7-1/5 oz. of kernel per lb. of nuts, a fair cropper only, unless a pollenizer is provided.

I.X.L.—Tree upright, rather vigorous, branches straight, medium dense, requires little pruning; nut medium to large, rather flat, soft shell, ovate, wide in proportion to length, ventral edge much curved, very light to dark brown; kernels, doubles only occasional, medium to large, flat and thin, wrinkles when dry, broadly ovate, apex broad, thin small tip; 160 nuts to the pound, kernel 6·5 oz. per lb. of nuts; good cropper; average annual yield 15 to 20 lb. nuts.

Jordan.—This type is supposed to have originated in France, and the name is a corruption of the word Jardin (garden). While there are several types, they more or less possess similar characteristics, viz., tall upright trees, generally bearing soft shelled nuts, which are long and narrow, very long in proportion to the width, with long, flat, narrow kernels having a thin apex

Kernels—top, I.X.L.; bottom, Ne Plus Ultra.

Left, I.X.L.; Right, Ne Plus Ultra.

with a blunt tip. The better known variety in Australia is the Early Soft Shell Jordan (q.v.). Jordan is not a popular variety in America.

Jordan, Rock Strain.—This is a Spanish almond introduced into the United States of America by John Rock. Tree and branches upright with dense foliage and smooth bark; nut long and narrow, dark brown, pits very small, rounded on dorsal side, curve extending over top, practically no tip, meeting dorsal side which is only slightly curved, base level and flat; kernel crescent shaped, curved on dorsal side and straight on ventral side, no point, only slightly grooved.

Languedoc (only occasionally catalogued in Australia).—Tree tall upright and vigorous, foliage not dense; nuts small to medium, ovate, plump; kernels, some doubles, size medium, cinnamon brown, thin and tender; 190 nuts per lb.; 6·6 oz. kernel per lb.; a light cropper; *distinctly biennial* in habit.

Lewelling (not Llewllyn).—Tree spreading, slow growing, straggly, foliage fairly dense; nut medium roundish oval, wide, broad at base, apex plump, bluntly, pointed; shell soft, light to dark brown, often reddish brown; kernel small to medium, many doubles, irregular in shape, round at apex, small point; heavy bearer, 160 nuts per lb., nearly 6½ oz. of kernel to pound of nuts.

Marie Duprey.—Tree moderate in size; nut large, plump, ventral edge almost semi-circular, dorsal edge almost straight or slightly curved inwards, this easily distinguishes it from all nuts; kernel long, crescent shaped, many doubles, dark brown, quality poor; 118 nuts to the pound; kernels 5 to 9 oz. per lb.; a good cropper.

Ne Plus Ultra.—Tree vigorous, spreading; foliage dense; nut medium to large, very soft shell, rather flat, long oval, much curved, especially

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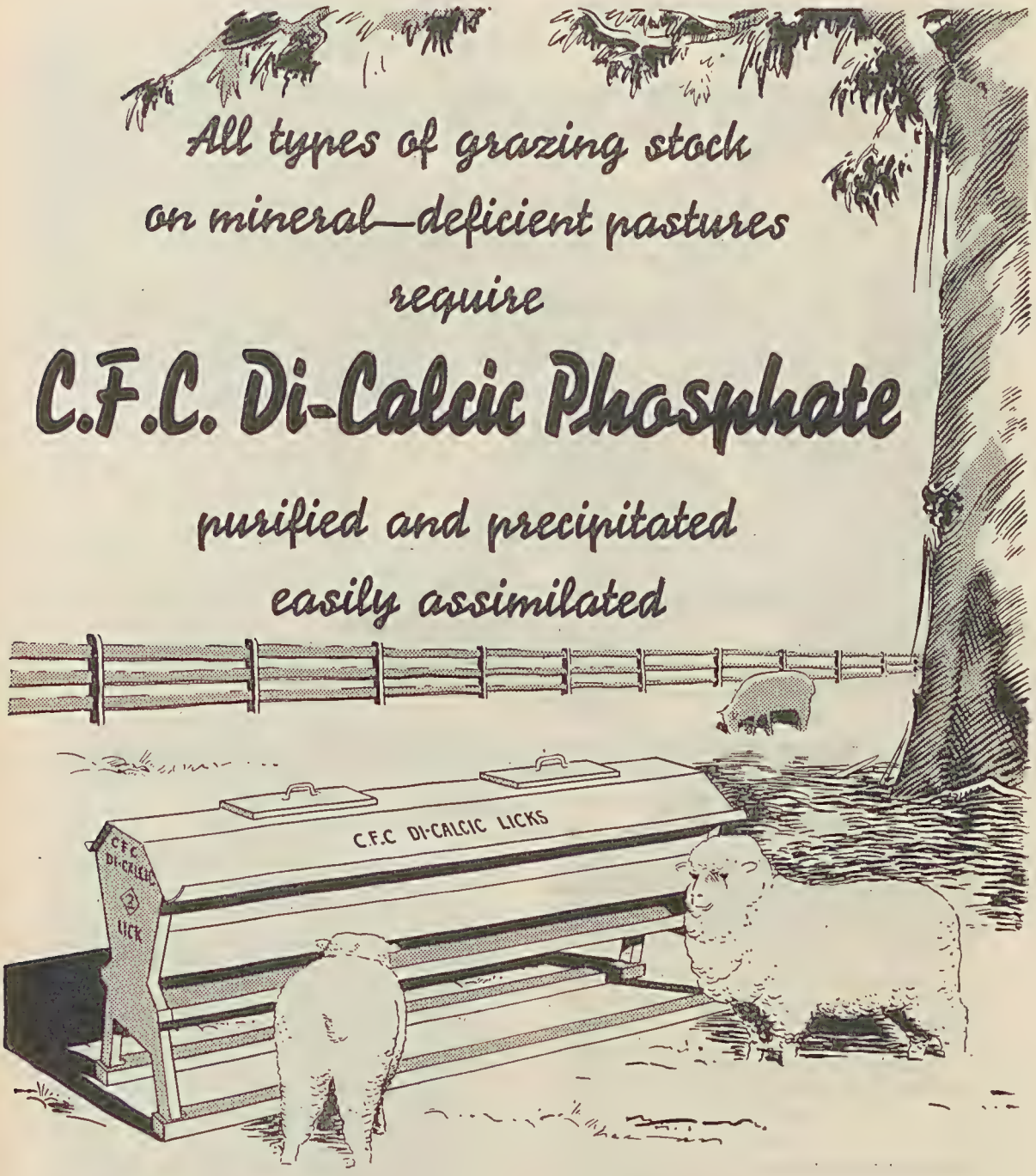

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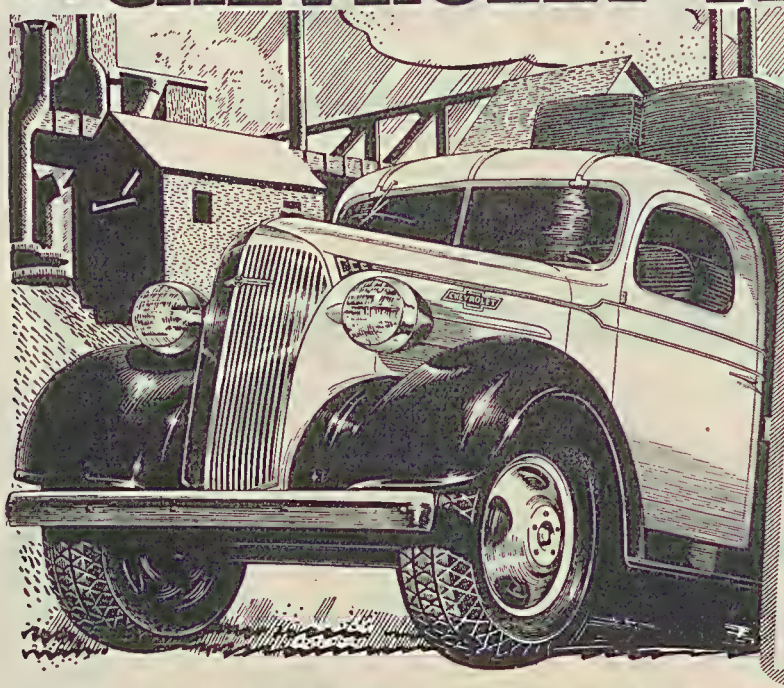

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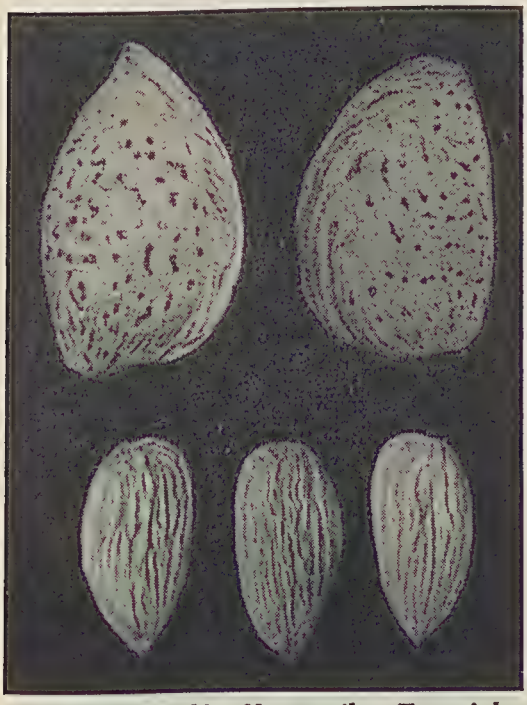
Left, Peerless; Right, Chellaston.

at apex, but often at base; apex pointed, ending in a long sharp thin wing; greyish brown to light brown; kernel sweet, some doubles, medium to large, has a tendency to form gumming defective kernels; 150 nuts per lb.; kernels 6·4 oz. per lb. of nuts; cropping good, but irregular.

Nonpareil.—This is by far the most extensively planted almond in the United States. It was raised by Mr. A. T. Hatch, who also raised at the same time I.X.L. and Ne Plus Ultra. Tree a moderately vigorous grower, tall and straight, spreading; outer branches drooping; a regular bearer; nut medium to quite large, flat, ovate, ventral edge thin and much curved, wing thin and prominent, shoulder sloping; apex pointed; paper shell, light to dark brown; kernel seldom double, size medium to large, thin, oblong ovate.



Top left, Hatch's Nonpareil; Top right, Peerless; and lower, Hatch's Nonpareil kernels.

Peerless.—There are two types of Peerless almonds.

(*a*) The Californian variety, which occupies sixth place of importance in the United States. It is a vigorous tree, upright, with dense foliage; nuts small to medium, 100 to 150 to a pound, wide ovate, curve of both edges much the same; wing thick, base plump and broad; shell somewhat hard; many double kernels, many gummy nuts; nut with a clean, light-coloured smooth shell.

Showing the tall drooping habit of the Sultana variety of Almond.

(*b*) The South Australian variety, known as Riverside Peerless, a selected variety raised by Mr. H. Wicks, of Payneham. It is a very willowy and pendulous tree, a disability which may be somewhat corrected by pruning. It is a consistent bearer, with 150 nuts per lb., averaging over 50 per cent. of kernel by weight. Nut medium size, flattened and tapering; shell very smooth; soft clear brown, moderately firm. The nut is broader than the American variety, and the apex point is more shouldered.

Sultana.—A Spanish almond; tree tall, drooping with dense, deep-green foliage. Nut large, 120 to 140 to the lb., kernel about 6 oz.

per lb. of nuts; nut flat and wide, curved dorsal edge about one-third larger than ventral, which is only slightly curved; point blunt; base wide and flat. Shell dark-brown, not very thin; pits numerous, small to medium, deep. Kernel large, inclined to be deformed, a tendency to form doubles; flavour

Left, Fine de Dames; Right, Pistache.

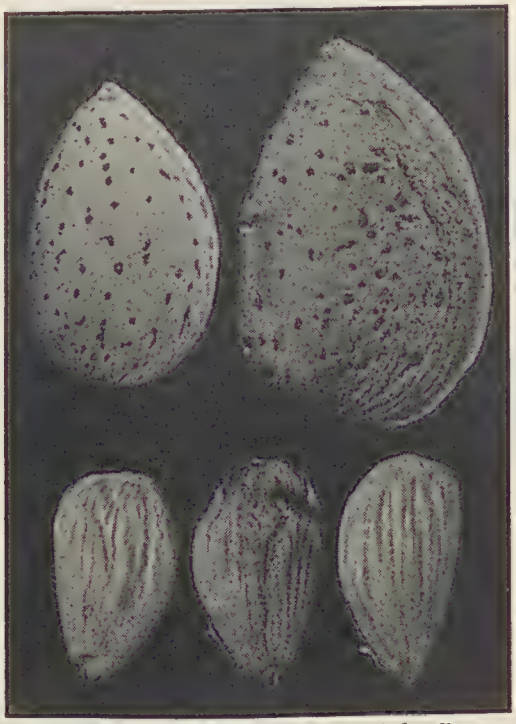
fair, slightly sweet. The dark shell and the deformed and double kernels are not in its favour.

Pistache.—Tree upright in growth, with many short twigs and laterals. Nut very small, 250 to 280 to the lb., with 50 per cent. of kernel; very plump, round ovoid, ventral

A Brown Brandes Almond tree.

edge much curved; wing quite pronounced; base very round and plump. Shell soft, thin, light-brown; pits small, deep, and numerous. Kernel, doubles frequent, fitting shell cavity well, plump, small, and ovoid. The smallest nut grown.

Fine des Dames.— A semi-hardshell, originated in France; not commonly grown. Nut small, heart-shaped in general outline, the



Top left, Brandes Jordan; Top right, Brown Brandes; and lower, Brande's Jordan kernels.

dorsal side being much larger than the ventral, the V of the "heart" being on one side, curves even, wing almost absent, very pointed; pits rough, deep, and irregular. Kernel large, filling cavity well; nuts 155 to 160 to the lb., 4 oz. kernel per lb of nuts; crop good.

Showing the tall, stately habit of the Brande's Jordan variety.

Left, Pitkin's Brandes; Right, White Brandes.

AUSTRALIAN ALMONDS.—THE BRANDES GROUP.

Brande's Jordan (not a typical Jordan).—Tree tall and stately, often used as a windbreak; nut medium size, plump, dark brown, wing slight, shoulder high, sharply pointed, rows of pits very noticeable on ventral side; kernel medium size, light brown, point evenly placed on top; no doubles.

Adam's Brandes.—A straight tree, an erratic bearer; nut long, point blunt, winged near top, very few holes; kernel flat, sharp and even point, broad at base, plump, no doubles.

Brown Brandes.—Nut even in outline almost heart-shaped, dark brown, point winged, few holes; kernel flat, thin, and very evenly shaped, 7 oz. to the pound of nuts. The tree is an upright one.

Showing the moderately erect growing habit of the variety Chellaston.

Pitkin's Brandes.—A straight tree; a heavy bearer; nut darkish brown, rough ridged at base, pits small and deep; long, large, both sides curved, dorsal much more than ventral; tip flatly winged, wing coming from dorsal side; kernel broad and flat, point shouldered.

White Brandes.—Tree spreading; nut large, clean, even, light coloured, rounded, flat at base, well curved on dorsal side, not winged; kernel flat, ridged, pointed at tip, rounded point at base; heavy cropper.

OTHER AUSTRALIAN VARIETIES.

Brown Nonpareil.—Nut slightly darker in colour than White Nonpareil, straight and square at base, almost semi-circular in outline, ventral edge almost straight, forming nearly a right angle with the base; kernel similarly shaped, flat, point blunt.

Chellaston is the most extensively planted variety in South Australia.

Chellaston.—A vigorous and moderately erect growing tree, quite bushy, requires free pruning when young; nut light coloured, conspicuously winged, broad at top, inclining to level at base, no point, top quite blunt, ventral edge almost straight; kernel small, almost oblong, except for an even blunt top; kernels 7 oz. per lb. of nuts. This is the most extensively planted variety in South Australia; a heavy and consistent bearer.

Early Softshell Jordan (Wicks).—Not true Jordan type, but more so than Brande's Jordan; dark brown, scattered deep pits, plump, flat on base, dorsal side winged, crescent shaped to a point, ventral side almost straight; kernel medium size, plump, shouldered, very pointed.

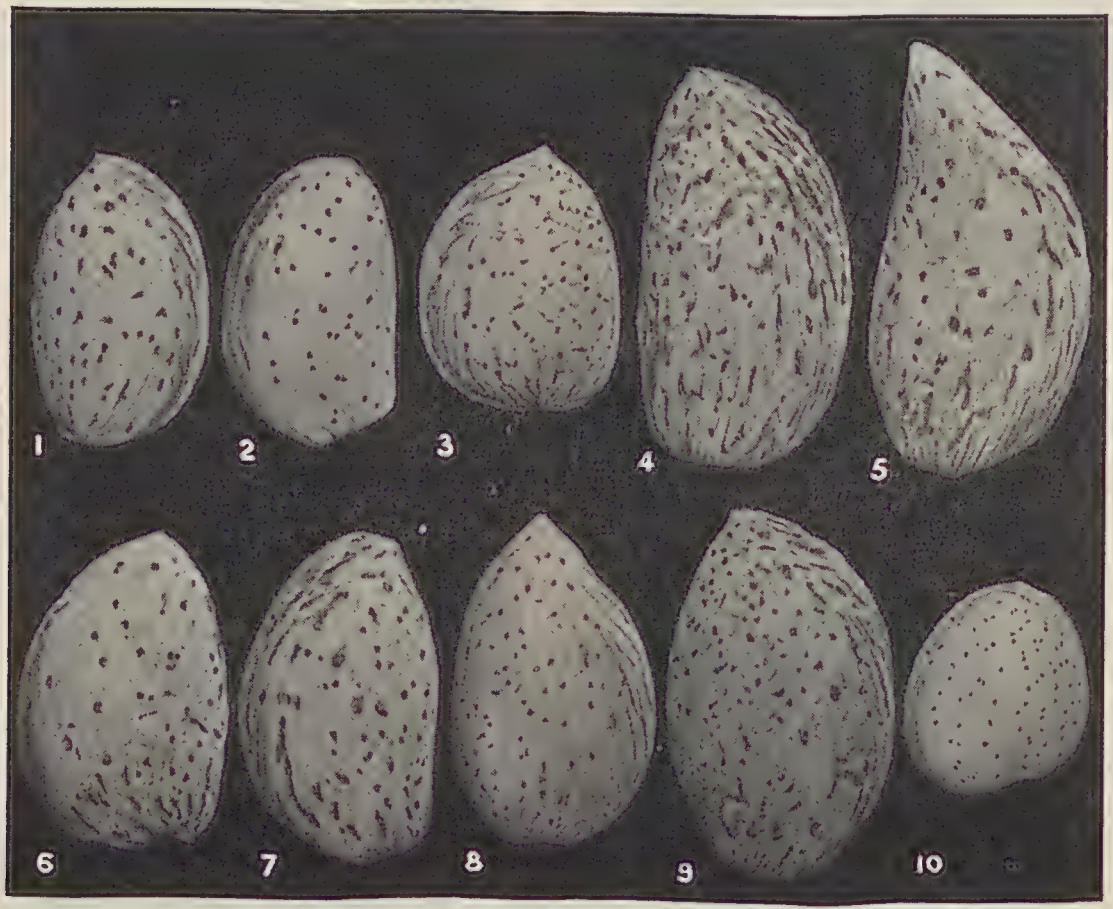
Johnson's Prolific.—Tree strong, spreading, and upright in growth; a heavy bearer; nut medium brown, large, long, level at base, ventral edge with longer curve than the dorsal, not winged, pointed, slightly winged at top, dorsal edge curved; kernel long, flat, pointed; no doubles.

*Jose's B.*1.—A strong growing and usually spreading tree, with rich green leaves; a good bearer; nut large, light brown, long and narrow, almost sickle shaped, ventral edge very curved, long point inclining over to the dorsal side, which is then almost straight; kernel sickle shaped, point on dorsal side, 6 oz. per lb. of nuts.

Selgar.—Nut rather thin, squat in appearance, light brown with a few deep dots, more abundant on the broad or dorsal side; ventral side only slightly winged or keeled, tip quite blunt, base broad and rough; kernels 7½ oz. to the pound of nuts.

Kernels of Early Softshell Jordan.

White Nonpareil.—A fairly large spreading tree, with a fair cropping record in hot districts; nut very clean, light brown, dorsal edge curved and winged, extending to top, no tip, dorsal edge almost straight; kernel small, unevenly rounded at base, evenly shaped and pointed at tip.



1, Brown Nonpareil; 2, Chellaston; 3, Early Jordan; 4, Johnson's Prolific; 5, Jose's B.I.; 6, Selgar; 7, White Nonpareil; 8, Whibleys Perfection; 9, Imperial; 10, Common Hardshell.

Whibley's Perfection.—Nut hardshell, medium size, dull brown, clean shell, slightly pitted only, much rounded at lower half, almost evenly sided, long even pointed tip; kernel flat, evenly shaped, fairly thin. When this nut was introduced a few years ago, it gave great promise of being an excellently flavoured almond. But recently, and especially on young trees, it has developed a slight bitterness in the flavour, and that quality will definitely cause its rejection as a nut either for dessert or confectionery purposes.

Imperial.—Originally issued as "Imperial Papershell," raised by H. Wicks in South Australia. Nut almost semi-circular, with a distinct even curve on the dorsal side and almost level on the ventral side, with a slight hump near the tip. Base small and flat; point almost absent. Pits numerous, small, scattered and deep. Kernels 5 oz. per lb. of nuts.

Common Hardshell.—The "common" is usually a medium-sized to small nut, dull in colour, quite smooth, with fairly deep pits. It is a good cropper, giving very sweet kernels. It is not much grown, but, with the advent of nut-cracking machines, it may increase in popularity.

The following record of flowering and ripening dates, as well as the weight of kernels per lb. of nuts was collected in 1936–37 at the Burnley Horticultural Gardens :—

Variety.	Flowering (full).	Ripening.	Weight of Kernels per lb. of Nuts.
			oz.
Brande's Jordan ..	2.8.36	26.2.37	8·1
Burbank	20.8.36	1.4.37	6·8
Chellaston	3.8.36	1.4.37	8·4
Early Jordan ..	7.8.36	24.2.37	8·0
Golden State	14.8.36	16.3.37	10·6
Hatch's Nonpariel ..	14.8.36	24.2.37	11·3
Harriott's Seedling ..	3.8.36	19.4.37	8·25
I.X.L.	27.7.36	8.3.37	10·6
Nonpariel	10.8.36	1.4.37	8·6
Peerless	27.7.36	5.3.37	8·3
White Nonpariel ..	12.8.36	27.2.37	8·6
Large Paper Shell ..	31.7.36	12.3.37	10·6

Stocks.

All varieties of almonds, of course, have been raised from seed, but the commercial varieties at present grown have been selected from many hundreds of seedlings, the majority of which would be hard-shelled; while many also would be quite bitter and inedible. It is therefore necessary to work existing varieties on suitable stocks so that suitable crops shall be produced.

The stocks more commonly used by Victorian nurserymen are peach seedlings; while South Australian nurserymen work the fruiting varieties on almond seedlings. There appears to be no definitely established reason for this geographical distinction, although it would seem from available information—admittedly inadequate—that where the climate has a heavy rainfall, or in irrigation districts, the best stock is the peach seedling; but in the hot and drier areas where the almond grows to perfection, the almond stock is the more suitable. Further, it has been suggested that the peach stock has a dwarfing effect as compared with the almond stock.

There is still room for investigation in these directions, and also as to whether the sweet or the bitter almond gives the better stock. From general observations there seems to be no difference between these two, but a close study has not yet been made.

Almonds germinate very freely in Victoria. But it cannot be overlooked that all of the large Victorian nurseries are in heavy rainfall localities, and various leaf fungi take a heavy toll of the foliage until the end of the year. It is often difficult, therefore, to get vigorous growth into the young stocks.

Pollination.

The principal limiting factor in the cultivation of the almond is the question of cross-pollination. It has been established that there must be an inter-planting of varieties that flower at or about the same time, to provide for cross-fertilization. The question of synchronous flowering has received considerable attention in the almond-producing States of the Commonwealth; but the allied subject of inter-fertility or suitable pollenizers for each variety has yet to be studied, as well as the question of the viability of the pollen. Almond growers should therefore plant a number of varieties, having definite coincident flowering periods, so that pollen of more than one variety shall be available for the purposes of cross-pollination.

It will be seen that it would be of no use to plant Peerless and Brande's Jordan as pollenizers for Burbank or Gros Tendre. In this respect, therefore, it would be wise to plant several varieties, owing to the fact that the first date of blossoming varies with the season. Thus at Swan Hill, in 1933, Nonpariel opened its first flowers four days earlier

than in 1932; while in 1933 Burbank flowered for nearly three weeks longer than it did in 1931.

The accompanying table shows the necessity for a careful selection of varieties.

Variety.	Half-flowers.	Full-bloom.	Flowering finished.
Peerless	July 26	Aug. 1	Aug. 9
Brande's Jordan ..	July 26	Aug. 1	Aug. 7*
Ne Plus Ultra ..	July 26	Aug. 3	Aug. 8
Early Jordan ..	July 26	July 31	Aug. 6
Harriott	July 29	Aug. 4	Aug. 9
Golden State	July 30	Aug. 5	Aug. 9
White Nonpareil ..	Aug. 1	Aug. 10	Aug. 14
Nonpareil	Aug. 2	Aug. 8	Aug. 13
I.X.L.	Aug. 5	Aug. 9	Aug. 14
Hatch's Nonpareil ..	Aug. 9	Aug. 16	Aug. 23
Burbank	Aug. 14	Aug. 19	Aug. 29
Gros Tendre	Aug. 15	Aug. 20	Aug. 30

* Old trees.

The date given in the first column (half-flower stage) appears to be the beginning of the effective period of flowering rather than the time of the early flowers.

Weather conditions undoubtedly accelerate or retard the flowering period. In addition, inclement weather destroys the flowers and injures the viability of the pollen. Unsuitable weather conditions also interfere with the flight of bees, which are the chief agents in the distribution of the pollen. Old trees often finish flowering a few days earlier.

Seasonal flowering of varieties is indicated as follows:—

(*a*) *Early flowering varieties.*—I.X.L., Sultana, Paper Shell, Nonpareil, Large Paper Shell, Early Soft Shell Jordan, Ne Plus Ultra, Peerless, and Brande's Jordan.

(*b*) *Mid-season to late flowering varieties.*—Harriott, Marie Duprey, Burbank and Golden State.

Of several varieties, such as Chellaston, Johnson's Prolific, Jose's B.1, Whibley's Perfection (hard shell), Selgar, Stockham's, little or no information is available regarding pollination. It may be taken, however, that all of the Brande's types will flower about the same period; this includes Chellaston, which belongs to this strain.

One of the later flowering varieties is Harriott; on that account it is rarely planted owing to the lack of a suitable pollenizer. However, a late blooming hard-shell variety has been raised in the Mornington Peninsula, and is reported to fill all the requirements for cross-pollinating Harriott.

General Culture.

Encouragement of tree growth by systematic pruning is essential, and this should be followed up with reasonable attention to soil requirements. The cultivation that is given to any orchard tree should be extended also to the almond.

If the soil be poor, a dressing of blood and bone may be given during the early growing period. The use of lime in autumn is an important factor. The best method of supplying plant food is by the use of green manures, especially if the trees are grown in hot or dry climates. Any form of green manure may be given—peas, beans, lupins, or tares—either in association with oats, barley and rye, or by themselves. The crop should be ploughed under in early spring.

Apart from the ordinary problems of soil and soil drainage, the chief limiting factor in almond culture is the action or presence of spring frosts. When bud development is advancing, the whole bud system is susceptible to frost action, and one frost will kill all of the buds on a tree. Frost too will kill the young almonds if it should come before the shells begin to "stone" or harden. Some attention therefore should be given to the practice of orchard heating to protect the trees during a frost.

Birds are one of the almond growers principal minor pests. Parrots feed on the young flower buds and also on the newly formed nuts. In some districts crows cause considerable trouble when the nuts are ready for harvesting. They steal nuts from the tree, and knock down far more than they take. Then they feed upon, or carry away, those that drop to the ground. They are even known to enter houses and sheds where the nuts are stored, to carry away booty. There is no remedy beyond constant watchfulness. Nuts should not be left exposed in the harvesting season; all nut sheets should be covered and all nut sheds closed at night.

Pruning.

In Victoria pruning is a very necessary, but a very much neglected, operation. The first few years of the tree's existence should be devoted to the proper shaping of the tree. An almond tree may be allowed to have more leaders than a peach or an apricot tree. The framework should be strongly built by cutting back the leaders in winter, and by pinching back the strong shoots during the growing season, so as to regulate the whole growth and make each shoot of even development. The trees begin to bear in the fourth year, and

Peerless—unpruned.

Brown Brandes—pruned.

they reach a fairly high average yield from the seventh to the tenth year.

In addition to shaping the tree, attention should be given to a satisfactory management of the lateral system. Almond trees produce far more laterals than they require, so that the lateral system should be evenly spaced, thinning out those that are growing too closely together. Old fruiting laterals and spurs should be removed, thus encouraging the tree to make new growth annually.

Owing to the early growth made by the trees, pruning operations should be done very early in winter, and not later than early June. Most varieties can be pruned to advantage, the new growth coming in the first season. In other varieties, notably Brande's Jordan, new growth does not come readily. Sultana is another variety that makes a slow response to lateral pruning.

The laterals of the almond continue their growth each year like other stone fruits, and as each year passes, the growth continues at the tip, leaving the back of the lateral quite bare of growth. Thus the laterals all tend to bear bunches of nuts on the ends, with occasional odd nuts towards the base. This is seen in the illustration of the unpruned growth of Peerless. Shortening back the laterals results in a vigorous and flowering growth, and in a more even distribution of the flowers. Thus the nuts are spread all along the lateral. This is illustrated in the photograph of the Brown Brandes pruned.

As suggested above, this immediate improvement does not come with all varieties. One year's pruning observations indicate that Chellaston, Peerless, Burbank, Jose's B.1, and others quickly respond.

Then there is the treatment of the close, compact growing varieties, such as Chellaston. Any variety that tends to produce a dense growth in the centre of the tree should be vigorously thinned to allow light into the centre. Such varieties invariably bear a crop of fruit on the outside of the tree only. If the tree is opened up by cutting out a number of internal limbs and large sub-leaders so that sunlight can play freely all through, an inside as well as an outside crop will be carried. The opening of the tree is seen in the illustrations of the Riverside Peerless unpruned and pruned.

It probably will be found subsequently, when the pruning of almond laterals be studied for several years, that the production of a satisfactory system of almond laterals will be worked on the same basis as that of peach pruning, viz., the pruning back of the laterals alternately, year by year, so as to maintain a system of new lateral production each year.

Systematic pruning observations were commenced at Taminick, in the winter of 1937, and will be continued over several years. The following is a progress report on this work:—

Chellaston.—This variety can be pruned to advantage, as the inside of the tree is usually barren, it being such a close-growing type. It is, therefore, advisable to thin out the centre of the tree heavily to allow the admission of plenty of light and air. All lateral growth can be shortened back similarly to the methods employed with dessert varieties of peaches.

Sultana.—This variety does not respond readily to the pruning of its laterals. It is suggested that only occasional limbs be removed from the centre of the tree to allow the entrance of light and air. Laterals should be left unpruned.

Peerless Riverside—unpruned and pruned.

Peerless.—This variety may be pruned to advantage; laterals may be shortened back to 5 or 6 inches, and a good set may be expected to follow; whereas laterals uncut very often set only a few nuts on the tips. Shortened laterals also appear to throw out good young growth for the ensuing year.

Brown Brandes.—This variety can be treated similarly to Peerless. If lateral growth is left unpruned, it appears to bear only on the tips.

Brande's Jordan.—This variety does not appear to respond freely to lateral pruning in the first year. It may be better to head back the main leaders slowly, and to prune lightly.

*Jose's B.*1.—This variety is naturally a short spurring variety, and can be pruned in the same way as the dessert varieties of peaches. Jose's B.1 has not yet proved satisfactory in the North-East of Victoria as it produces a large number of double malformed kernels.

Commercial.—Prune similarly to Brown Brandes.

Burbank.—All lateral growth may be shortened back similarly to the treatment of Brown Brandes.

Harvesting.

The almond crop is harvested when the hulls have opened well and when the first few nuts are beginning to drop. Harvesting should not be commenced too early, as the nuts are hard to displace, and the hulls stick to the shells.

Strong sheets of duck canvas are spread under the trees, and the nuts are knocked down by striking the branches and the nuts with long bamboo poles or rods; or, if bamboo be not available, with long pine rods. Bamboo rods do less damage to the trees than any other.

Should the nuts be found sticking to the hulls when harvested, hulling should be done at once, as the nuts are much harder to remove when they are dry. Indeed, it may be necessary to soak the dry hulls in water in order to effect a satisfactory removal.

After harvesting, the nuts should be quickly and thoroughly dried in the sun. On no account should they be dried slowly or left too long in the sun, as under such conditions the shells darken rapidly.

Discoloured or dull coloured nuts are bleached to give them a good appearance. The nuts are first of all steamed for from 15 to 20 minutes, submitting them only to low pressure. Then they are placed on trays in an air-tight box or chamber, and submitted to the fumes of burning sulphur for 20 to 30 minutes. Cracked or very thin paper-shelled nuts should not be sulphured, as the sulphur fumes will penetrate the kernels and render them unpalatable. Three pounds of the best flowers of sulphur (not block or lump sulphur) is required to bleach 1 ton of almonds.

Almond nuts should not be stored until they are thoroughly dry, as damp almonds very quickly discolour and develop mould. They should be stored in a damp-proof building, which is free from attacks of rats, birds, or any other vermin.

Prepared chemical dips have been used for bleaching almonds, the principal one being a 1 per cent. solution of sulphurous acid. But such dips have generally proved unsatisfactory owing to the solution being absorbed by the kernels and permanently tainting them.

A citrus grove protected by windbreaks of almonds.

Nut-Cracking Machinery.

At present there are two types of nut-cracking machines operating in Victoria which are designed for the successful removal of the kernel from the nut without breaking the kernel. Both of these machines are stationed in the warm northern areas where almonds are extensively grown. They were both designed and developed in South Australia, and are known as the Ragless and the Hoadley machines. Both types are doing their work well, and are so constructed that they will crack hard shells as well as soft shells. The percentage of broken kernels is very low. "Stickfasts" or "sticktights," that is a condition in which the hull is sticking to the shell, are also easily dealt with by these machines.

Production per Tree.

It is difficult at the present time, owing to lack of information, to estimate the average production of an almond tree in Victoria. Government statistics show an exceedingly low tree-production, but these are undoubtedly the result of careless or inaccurate observations on the part of growers, or the fact that no records are kept and that estimates are guesswork. Then again the almond generally has been looked upon as a hardy tree upon which no care need be bestowed. Thus it was planted along boundary fences and similar places, and left to its own devices. It was rarely cultivated, never pruned, never sprayed, and very rarely fed. And also for some unknown reason, it was regarded as a wet climate tree. Thus statistical records show that our average almond production is less than 4 lb. per tree, and such is not to be wondered at.

In South Australia, at the Hackney Experiment Station, the average production of almond nuts per tree, taken over a period of sixteen successive crops was 14 lb. These trees were growing on the average Adelaide plain soil, which is an exceptionally good one. In commercial orchards in this district, yields per single tree of 20 to 30 lb. would not be rare, although the orchard averages probably would be in the vicinity of 10 to 15 lb. per tree only. At the experimental orchard at Berri on the Murray in South Australia, an average yield over a period of eight years was nearly 8 lb. per tree. At the Burnley Horticultural Gardens some of the trees each yield 16 lb. per annum.

Recommendations.

1. In future plantings more attention should be paid to the planting of certain Australian raised seedlings that are largely grown in South Australia, such as Jose's B.1, Selgar, Chellaston, Imperial, Peerless, Johnson's Prolific, and White Brandes.

Chief among the introduced varieties are I.X.L., Hatch's Nonpareil, and Ne Plus Ultra.

2. A good deep type of soil should be chosen rather than "planting anywhere" as is the practice at present.

3. Pruning (thinning) and green manuring should receive a good deal more attention than is the case to-day.

(The Chestnut Walnut, etc. will be dealt with in subsequent issues.)

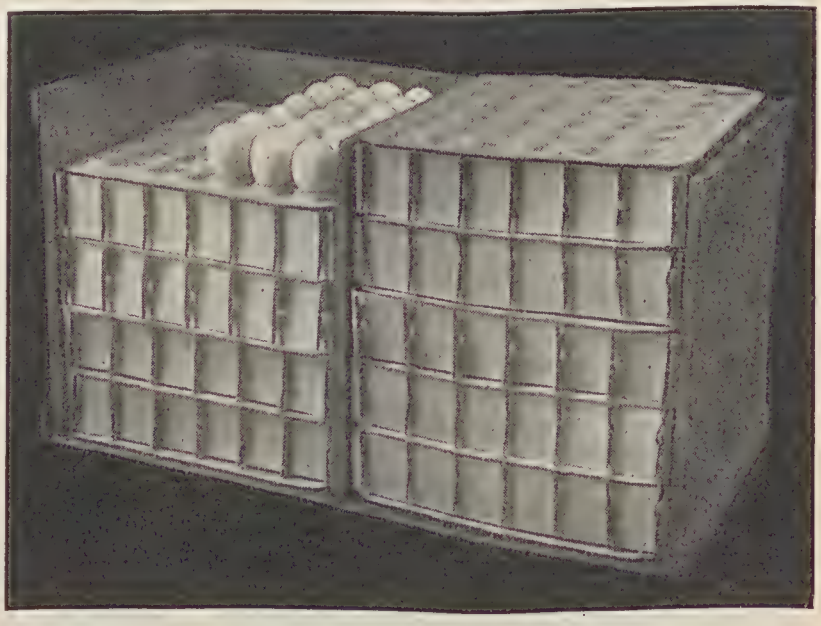
Marketing Eggs

By H. F. Clinton, Poultry Expert.

SUCCESS in marketing of any product is dependent, to a very large extent, on the maintenance of a high standard of quality. This is specially true in the case of eggs, for eggs of poor quality affect, very appreciably, the demand and the price. The egg has usually been considered of perfect quality when new-laid, but we now know that eggs are not all of the same quality when laid, and that some eggs, though of good quality when new-laid, deteriorate much more quickly than others, even when stored under the same conditions.

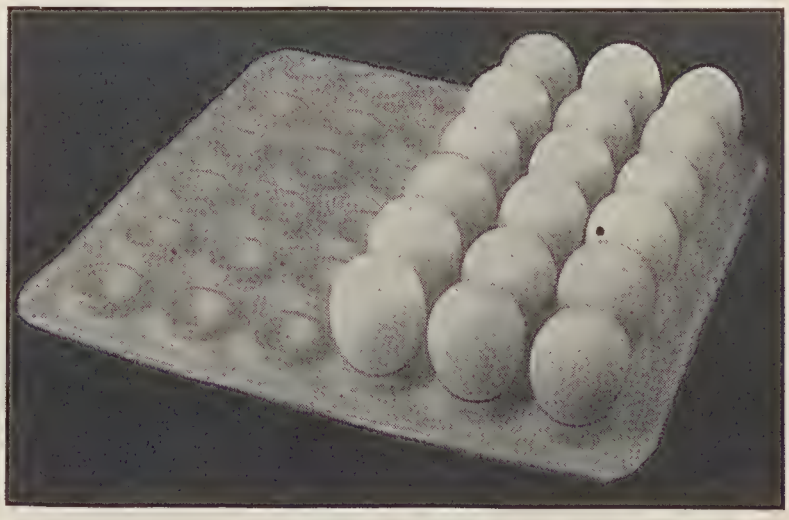
The testing of eggs for quality on a commercial basis is done by candling. Candling means the examination of the egg shell and its contents in front of a strong ray of light. The quality is assessed according to the translucence of the egg when held before light, and the method is generally regarded as extremely accurate in expert hands. The chief points which can be noted in candling are :—texture of shell, size of air space, visibility and condition of yolk, condition of white and presence of foreign bodies. By candling, it is comparatively easy, even for the inexperienced, to detect small cracks, foreign bodies, and size of air space, but the finer differences of internal quality can be judged only by a highly skilled worker. The defect known as watery white is certainly difficult to define in some cases. The true watery white egg is one in which the white runs all over the pan when opened for cooking. It is sometimes due to bad packing and rough handling in transit. It should be realized that this condition of the white is sometimes concerned with eggs that are new laid, and also that some eggs have thin and watery white through staleness, especially during the hotter months of the year.

The price received for eggs depends upon quality and size. Egg size is governed by breeding, feeding, and other factors, and it should be the aim of beginners to secure foundation stock from a recognized laying strain. Good results cannot be produced from indifferent fowls badly fed, and in this connexion, it must be emphasized that a hen when laying, is subjected to a heavy strain and must be well fed on a properly balanced ration if best results are to be obtained. The quality of eggs is affected by the feeding of unsuitable foods, by fertile eggs germinating during the hot weather, and by holding the eggs too long before being despatched to market. The eggs should be collected at least twice daily, and packed when cool in clean fillers and flats. Keep the eggs in a cool and well ventilated place free from direct draughts, in order to avoid excessive evaporation, and market twice weekly during the hot weather. Eggs should be stored in clean rooms away from produce or goods which emit odours. Deterioration of the contents of weak



Satisfactory results are being obtained in packing eggs with cushion or cup flats and fillers.

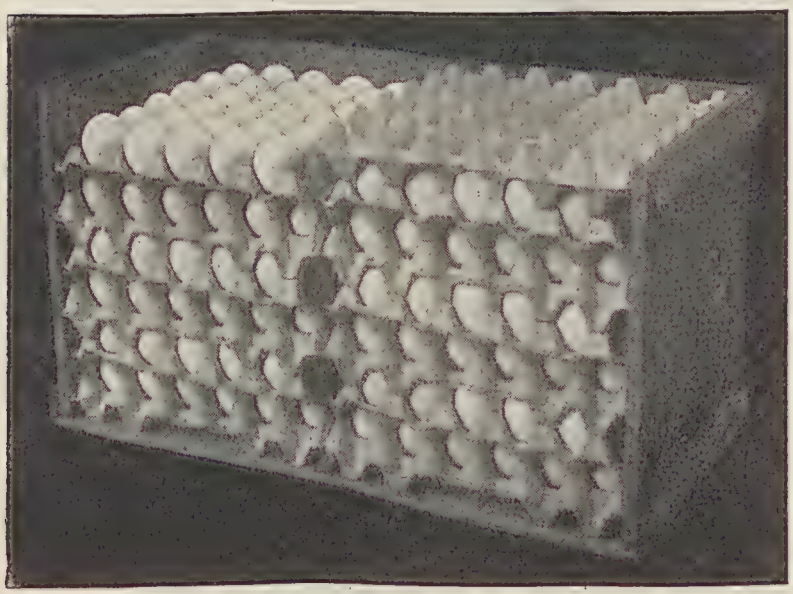
shelled eggs is more rapid, because the poor quality shell offers less resistance to evaporation, and because bacteria and abnormal odours more easily penetrate such shells when soiled. Eggs that are clean and of a good shell texture realize higher prices. Ample nesting accommodation should be provided, and the nests and nesting material should be clean and dry.



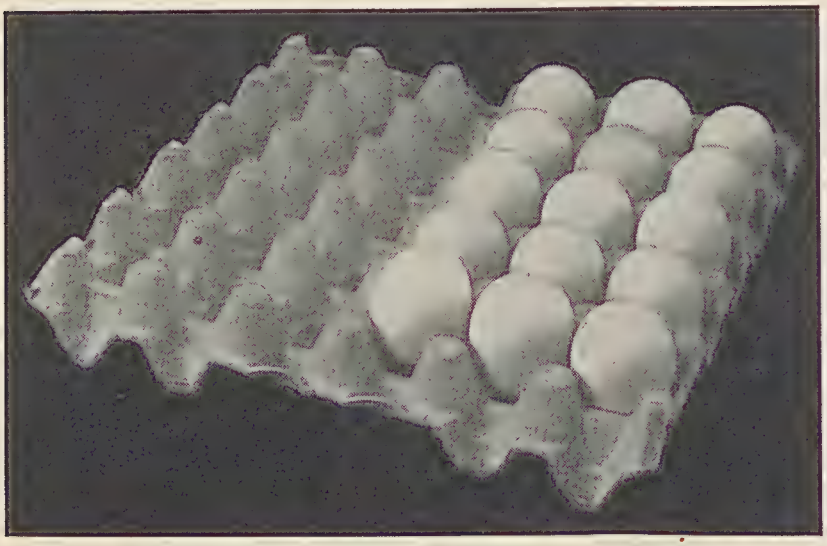
A cushion or cup flat.

The development of primary industries in Victoria has been accompanied by problems as well as by profits and benefits. Not the least of these problems is that associated with the elimination of waste in the handling and transport of eggs, which, being of a particularly fragile nature, demand special care at all times. The problem of better packing and safe transportation is one which should engage the attention of every person associated with the poultry industry. Quite a number of eggs are broken during packing, handling, and transport, and most of these breakages are due principally to faulty packing or bad handling. Producers should not be expected to protect their eggs against unreasonable transportation shocks; but carriers and others cannot prevent breakages of eggs which are packed in inferior containers. Eggs should be packed with the large end up. Long eggs are usually crushed or cracked in packing, and therefore no egg should be packed if it stands above the top of the filler. Generally speaking, carefully graded and properly packed eggs reach the market without breakage, and an unblemished pack of eggs naturally brings a higher price than one containing cracks and soiled fillers.

In packing eggs, care should be taken to see that the case and fillers are clean and in good condition. Ordinary flats and pads of wood wool have been used, but the type of flat known as the cushion or cup flat, which eliminates the use of chaff, wood wool, or any other substance to be placed in the case, is giving excellent results. When using cushion or cup flats, two flats are placed at the bottom of the case, one with the cup downwards and the other with the cup upwards. The filler is then placed on the flat and the compartments carefully filled with eggs. If the eggs are dropped in, they will become cracked, and probably develop a leakage during transit. Another cup flat is placed in the case with



Eggs packed in Keyes egg trays.



Showing the construction of a Keyes egg tray.

the cup upwards, and the packing continued until the case is full, and finally, one cup flat is placed on the top filler before closing the case.

There is also another type of filler on the market, known as Keyes egg trays. These have been used extensively for the export trade since 1934, and have proved a great success. They are being used also for the local trade. The 30-dozen case has been found to be the most economical for handling, packing, and transport.

All eggs for the local trade are sold in accordance with Regulations under the Health Act. Minimum weight grades are provided, and also special regulations apply to the sale of eggs that are chilled or preserved.

Eggs for Export.

The Commonwealth Egg Export Regulations prescribe, amongst other things, that eggs for export overseas must be clean. This means that the shells must be free from dirt, the contents of broken eggs and other foreign substances, and bear no stains from contact with these or with damp or dirty nests. They must also be free from dirty fingermarks, pencil or brand marks; in short, the shells should be just clean. The eggs are graded and packed for quality and size in cases each holding 30 dozen eggs (three long hundred). Eggs packed in chaff or wood wool are not accepted for the export trade.

Cold Storage of Eggs.

The recognition by medical men and food specialists of the food values of eggs has resulted in a steady demand for this nourishing and easily digested food; but it is possible no one thing has so greatly benefited the poultry industry as the cold storage of eggs. Many poultrymen will not agree with that statement; nevertheless it is true.

If it were not for the cold storage of the surplus eggs produced in the spring and early summer, prices for eggs during the winter would be so high that none but the very wealthy could afford to buy them. The bulk of the people would be debarred from the use of one of nature's best foods, and it would be difficult for managers of hospitals to find suitable substitutes to give to their patients.

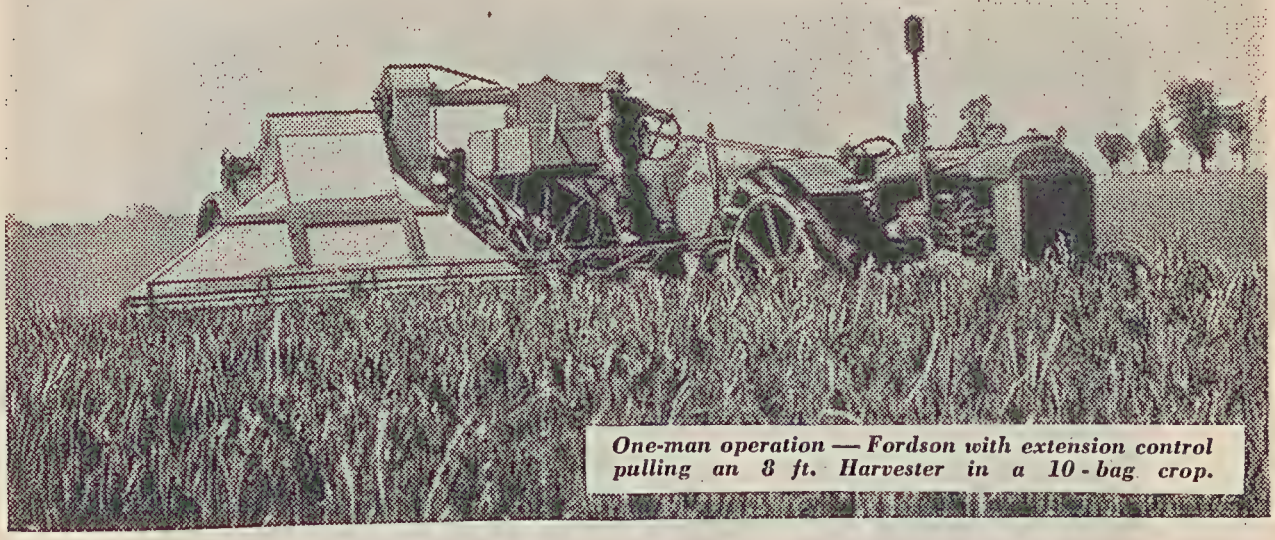
The producer benefits because during the time of high production thousands of dozens of eggs are taken off the market when prices are low, and this helps to stabilize the prices he receives.

Unfortunately, a section of the people has the opinion that, once an egg has been placed in cool store, it becomes an inferior article, and should not be sold in shell, but should be converted into egg pulp. Nothing is further from the truth.

Management has advanced with the times, and it is now possible to hold many classes of foodstuffs in perfect condition over very long periods. As far as eggs are concerned, cold storage has been brought to a very high standard of efficiency. It must be remembered, however, that by cool storing eggs, miracles are not performed. It does not make stale eggs fresh, or dirty eggs clean, or small eggs large, or cracked eggs sound; therefore, operations should be confined solely to sound, clean, new-laid, large eggs.

Provided eggs of this description are placed in store and the correct temperature maintained, they can be held for months, and when taken out will be in perfectly satisfactory condition; and no evidence has yet been produced that, so far as food value is concerned, cold stored eggs deteriorate in any way. Thousands of dozens are held at the Government Cool Stores every year, and after seven months' storage, have opened up in first class condition.

FORDSON ECONOMY FOR HARVESTING



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Blackhead in Turkeys

Compiled by the Veterinary Staff.

BLACKHEAD in turkeys (*Infectious entero-hepatitis*) is widely distributed, and is responsible for losses among turkeys wherever these birds are reared. In Victoria, it is the main cause of mortality in turkey-rearing establishments. It is also responsible for deterioration in condition of these birds, resulting in a direct economic loss to breeders. Deaths may occur in turkeys of all ages, although frequently, adult birds are not very seriously affected on properties where it proves almost impossible to rear young turkeys.

The disease may also occur in chickens, and during the last two or three years it has been the cause of serious mortality among chickens a few weeks of age. It is generally considered, however, that the disease is seldom of importance in fowls, although the parasite which causes it is a common inhabitant of the intestinal tract of poultry. In fact, fowls are now considered to be carriers of the disease, and where turkeys and fowls are kept in association with each other, the disease will appear among the former birds owing to their much greater susceptibility to the parasite.

Symptoms.

Symptoms usually appear in turkeys within a period of four weeks after exposure to infection. Young birds show less resistance, and the disease is more acute in them. Sometimes the only premonitory symptom is a drooping of the wings, and death occurs within a few hours. In less acute cases, the affected birds exhibit a drowsy appearance with increasing weakness, a diminished appetite, ruffled feathers, and a general debilitated appearance.

Diarrhoea is nearly always present, the droppings being soft, yellowish in colour or mixed with partially digested blood. Occasionally, owing to impaired circulation, the unfeathered parts of the head may present a dark bluish or purple appearance from which the name "blackhead" is derived; this, however, is not a constant symptom.

In adult turkeys, a loss of condition and a soft yellowish diarrhoea may be the only indications of infection. Frequently adult birds may recover, but they usually remain carriers. This carrier stage does not appear to be accompanied by an immunity, and relapses are not uncommon. The symptoms which we have observed in chickens are indistinguishable from those of coccidiosis, except that the haemorrhagic evacuations from the bowel are not observed.

Post-mortem Appearances.

The lesions are confined to the intestine (especially the caeca) and the liver. In many cases, only one caecum is involved, but frequently both are affected. In acute cases, there is a distension of the caeca, with yellow semi-fluid contents, and a congestion of the lining membrane. In less acute cases, the walls of the caeca become greatly thickened and covered by a yellowish exudate which frequently completely fills these structures. This accumulation of exudate markedly distends the caeca which are plainly apparent on opening the abdomen.

In the majority of cases, the liver is found to be involved with quite characteristic lesions. These consist of greyish or greenish-yellowish white firm areas, appearing on the surface of the liver, and they may be isolated, or so numerous as to coalesce; their diameter may vary up to that of a threepenny bit or larger. The liver is often congested, and enlarged to a considerable degree. The disease process in the caeca may lead to perforation of the walls, with a localized or generalized peritonitis due to secondary bacterial infection.

Treatment and Control.

Medicinal treatment for the cure of enterohepatitis is not of much value. Some workers have claimed good results with ipecacuanha, a drug which has given more or less satisfactory results in the treatment of amoebic dysentery of man, which is considered to be somewhat analogous to enterohepatitis. It cannot be claimed, however, that any known drug has a definitely specific action on the parasite. Once the disease has appeared, however, a great deal can be done to reduce the mortality.

All dead birds and their droppings should be destroyed by fire; feeding utensils cleansed and disinfected daily, and where possible quicklime should be applied to the run; food should be given in troughs.

One important factor in the transmission of the disease is the proved relationship of *Heterakis*

[*Continued on page 557.*

Lead Arsenate and Lime Sulphur.

Results of Analyses.

By W. C. Robertson, Chemist.

PRIOR to the current codling moth season seventeen samples of lead arsenate were collected and analyzed at the departmental laboratory, and in every instance they were found to comply with the standard required by the Act.

This standard, proclaimed in March of last year, reads, "Lead arsenate shall contain not less than 31 per cent. of arsenic pentoxide (As_2O_5), and not more than .5 per cent. of water soluble arsenic compounds (as As_2O_5), both calculated on the dry basis, and the acidity so calculated as nitric acid shall not exceed .2 per cent. Pastes shall contain not more than 50 per cent. of water."

Pastes.

The seven samples of lead arsenate in paste form which were collected all contained less than 50 per cent. of water and gave an average analysis of 32.34 per cent. of arsenic (As_2O_5), .14 per cent. of which was soluble in water, whilst the acidity was .08 per cent. calculated as nitric acid. All calculations from the samples of lead arsenate were made on the dry basis. The range of total arsenic (As_2O_5) in the samples of paste varied between 30.84 and 32.99 per cent. Calculating by the chemical formula of acid lead arsenate the sample showing the highest arsenical content was 99.60 per cent. pure. The average purity of the pastes collected and examined was 97.7 per cent. The single sample of colloidal lead arsenate which was collected, and which is not included in the pastes, gave the following analysis:—

Total Arsenic (As_2O_5).	Water Soluble Arsenic (As_2O_5).	Acidity (as Nitric.)
Per cent. 31·06	Per cent. ·20	Per cent. ·17

The low percentage of arsenic in this sample is probably due to its content of spreader.

Powders

The nine samples of lead arsenate in powder form which were collected and analyzed proved to be of lower quality (purity 96.1 per cent.) than the pastes. This is no doubt due to the larger amount of spreader or wetting agent used in their manufacture. In pastes, these agents are not often detected, the "gel" or "colloidal" nature of the precipitated arsenate being preserved during filtration; this obviates the necessity for any conditioning, whereas in the manufacture of the powder, its colloidal nature is destroyed during the drying process, and suspension must be brought about by the addition of agents which have the power of "wetting" the particles to give the colloidal effect. The average analysis of the samples of powder was:—

Total Arsenic (As_2O_5).	Water Soluble Arsenic (As_2O_5)	Acidity (as Nitric)
31·83	·16	·09

While this result is most satisfactory, and all the samples gave a good suspension, it should be remembered that a danger exists in the use of certain spreaders (for wetting agents especially) with any arsenate powder containing a percentage of similar spreader substances.

Spreaders.

The most commonly used spreaders are based on casein. Some on the market, however, are by no means pure caseinates, i.e., they do not consist of casein and a solvent only. Very often they are found to be adulterated with chalk, possibly with a view to stressing their spreading power. The casein solvent is usually lime or "limil," but, unfortunately, instances are frequent where sodium carbonate and bicarbonates are used as accelerators, and these alkaline salts in contact with lead arsenate produce soluble arsenic.

The main advantage claimed for the spreader is an even spread of the toxic substance on the fruit, with sufficient adhesiveness to hold the insecticide in position to give maximum results over a reasonable time, irrespective of the weather. But there are several disadvantages associated with spreaders which should be carefully considered prior to a decision as to their use.

The careless use of a spreader of unsatisfactory composition may (*a*) reduce toxicity by coating the arsenate particles with non-poisonous insoluble matter; (*b*) cause too great a run-off, thereby leaving a film of arsenate so thin that it will not provide a lethal dose for the insect; and (*c*) cause reactions with other sprays, such as white oil, to give further soluble substances (ammonia for example) having a great affinity with arsenic. These may dissolve the lead arsenate, and so produce comparatively large quantities of soluble arsenic, and cause injuries for which the orchardist will be unable to assign any reason. It is highly probable that these reactions are collective, and become more pronounced as the season advances, and the temperature increases. Without going into highly technical details, it will suffice to say that the alkaline salts of some spreaders, wetters, and emulsifiers will tend to react with lead arsenate to produce soluble arsenate, and even in the presence of excess lime or "limil" (when calcium arsenate would form) the amount of arsenic dissolved causes trouble. In this connexion the water used, often the only water available, may assist in the production of soluble arsenic because of its comparative impurity and consequent high ammonia content. Especially is this so when water has been contaminated with organic matter and debris.

As regards an even spread producing a toxic film, it is extremely doubtful whether the eye can detect the minimum spread for a lethal dose. It does not follow that the "blotching" caused by the spray running into drops is a sign that there is not a killable dose of the insecticide in between the drops, nor that the visible good "spread" or film obtained so easily when a spreader is used, means a toxic dose of arsenic to the grub, irrespective of where it may enter the fruit.

No matter what the method of spraying, most of the arsenate finds its way into the stem and calyx cavities, and none penetrates the flesh of the fruit. Arsenate manufacturers and salesmen warn their customers of the danger of using the soap spreader when spraying with lead arsenate, owing to the formation of soluble arsenic; yet soap is probably the best wetter and spreader in existence.

It is suggested that ammoniacal emulsifiers and the soda-lime casein spreader should be viewed from the same angle with the object of reducing their use to the absolute minimum.

TABLE I.—Analyses of Lead Arsenate Samples Collected under the Fungicides Act: Season 1937-38.

Number of Sample.	Brand.	Total Arsenic (As_2O_5).	Water Soluble Arsenic (As_2O_5).	Acidity as Nitric	Suspension.
		Per cent.	Per cent.	Per cent.	
No. 3603*	Elephant powder	31·70	·11	·14	Satisfactory
No. 3604*	Elephant paste	32·27	·11	·17	Satisfactory
No. 3605	Lion powder	32·08	·26	·08	Satisfactory
No. 3606	Lion paste	32·42	·20	·04	Satisfactory
No. 3607	Berger's mercury powder	32·46	·17	·06	Satisfactory
No. 3717*	Berger's colloidal	31·06	·20	·17	Excellent
No. 3718	Berger's paste	32·77	·11	·04	Satisfactory
No. 3719	Berger's powder	31·01	·06	·08	Satisfactory
No. 3778*	Cooper's arsinette powder	31·51	·24	·18	Excellent
No. 4187	Sherwin Williams powder	31·56	·11	·06	Satisfactory
No. 4188*	Aero powder	31·72	·09	·08	Satisfactory
No. 4190	Vallo powder	32·43	·17	·04	Satisfactory
No. 4191*	Aero paste	30·84	·09	·04	Satisfactory
No. 4192	Cooper's paste	32·21	·23	·11	Satisfactory
No. 4193	Vallo paste	32·99	·17	·13	Satisfactory
No. 4196	Blue Bell powder	32·39	·23	·06	Satisfactory
No. 4197	Blue Bell paste	32·86	·11	·03	Satisfactory

* Contain appreciable amounts of organic spreader.

A limestone quarry situated at Lilydale.

It is submitted that lead arsenate in paste form does not require the assistance of any spreader other than white oil, and that the amount of oil used should be carefully measured, and the quality of the water ascertained from the chemist of the Department by submitting a sample for analysis. Water condemned for use with lead arsenate might be eminently suitable for spraying with oil, Bordeaux, lime sulphur, nicotine sulphate, &c.

The use of spreaders of any kind with arsenate powders containing a spreader (which is usual) should be very carefully controlled. It is compulsory for the manufacturer to state on the label attached to any tin, drum or package containing lead arsenate whether it contains a spreader, wetter, or sticker, and any infringement of this requirement will be viewed seriously.

There are certain arsenates being imported into Victoria and distributed under a system of co-operation. Samples of these were not available when this inspection was made, but will be obtained later in the season. Lead arsenate distributed in this way must comply with the standard.

The analyses of the samples collected are given in Table I.

Lime Sulphur.

During August and September of this year eleven samples of concentrated liquid lime-sulphur and one of dry lime-sulphur (powder) were obtained from stocks at the manufacturer's factory or importer's store. With the exception of two, which were a little low in their percentage of total soluble sulphur, all the samples complied with the standard proclaimed, i.e.:—"The solution shall contain not less than 28 per cent. of total soluble sulphur, not less than 20 per cent, of poly-sulphide sulphur, and not more than 2.5 per cent. of thiosulphate sulphur, all calculated as percentage weight in volume."

The analyses of the samples which appear in Table II. appended show that the quality

TABLE II.—Lime Sulphur.

Number of Sample.	Brand.	Mono-sulphide Sulphur. Grams per 100 c.cs.	Thio-sulphate Sulphur. Grams per 100 c.cs.	Poly-sulphide Sulphur. Grams per 100 c.c.	Total Soluble Sulphur. Grams per 100 c.c.
3596	Lion	5·76	1·28	22·40	31·36
3597	Blue Bell	5·37	·77	23·68	30·50
3598	Elephant (T)	6·11	·64	22·08	30·72
3599	Elephant (D)	5·57	·77	20·48	27·33
3600	Buzacott	5·18	·90	21·32	28·49
3601	Buzacott	5·50	·64	21·60	28·74
3602	Neptune	6·65	·51	24·00	32·00
3716	Neptune	6·11	·64	23·68	31·57
4183	Vallo	6·68	·51	23·80	32·24
4184	Vallo	6·72	·51	24·00	32·26
4185	XL	5·66	·89	20·80	27·60
Average of 11 samples		5·94	·73	22·53	30·25
				[20·00]	[28·00]
4186	XL dry powder	10·98	1·92	42·66	57·90

Figures in brackets = manufacturers guarantee or standard.

of the brands of lime-sulphur is very uneven. Last year some of the higher concentrations tended to crystallize out after being placed in the commercial containers; this meant a decrease in strength. It was thought at the time that the figures of the proclaimed standard were probably the limit of stable quality for the commercial article. From this year's examination of the brands on the market it would appear that this is not so, because no crystallization has been detected or reported; yet the average quality of the eleven samples analysed is 22.35 per cent. of poly-sulphide sulphur; .73 per cent. of thio-sulphate sulphur; and 30.25 per cent. of total soluble sulphur.

The range in the percentages of poly-sulphide sulphur varies between 20.48 and 24, while 27.33 per cent. and 32.26 per cent. is the variation in the content of soluble sulphur.

The two samples which are a little low in total soluble sulphur show satisfactory percentages of poly-sulphide sulphur, but they infringe the Act, and render the seller liable to prosecution.

The percentage of sulphur as free poly-sulphide sulphur in the samples collected is approximately 75 per cent. This is a high degree of purity, especially when compared with the low grade lime sulphur of other years, the percentage of sulphur as poly-sulphide in which rarely exceeded 64 per cent. As poly-sulphide sulphur is the important and most valuable part of lime-sulphur, the degree of purity is of interest.

Recent inquiries dealing with the rate of dilution of the new concentrated lime-sulphur compared with the ordinary liquid raises the question of evenness in quality.

Dilution should be on the poly-sulphide content in preference to the percentage of soluble sulphur.

Liquid lime-sulphur prepared by the old method contained approximately 15 per cent. of poly-sulphide sulphur, whilst the average figure of the samples collected this season is 22.53. This means that 1 gallon of the latest concentrated lime-sulphur is equal to 1½ gallons of the old and less concentrated liquid, and where 1 gallon was used for every 100 gallons of water, to-day a dilution in 150 gallons of water would yield a spray of equal strength.

Blackhead in Turkeys (*Continued from page 553.*)

gallinae (the caecal worm of poultry) as a carrier of the parasite. Because the causal parasite of "blackhead" is a common parasite of the digestive tract of the fowl, and the caecal worm is found in both turkeys and fowls, the relation of this caecal worm to the transmission of the disease is a strong reason why turkeys should not be allowed to run with fowls, nor come in contact with hen runs. Further, young turkeys should not be raised in contact with adult birds.

The safest preventive measure consists in the hatching of turkey eggs in incubators, and raising the poults in enclosures and brooders on clean ground away from other birds. If it is necessary to keep the turkey chicks with the turkey hens they should be raised on clean, dry, well-drained pasture and changed frequently. Medicinal treatment with tobacco as recommended for worms may be tried as an adjunct to the hygienic measures.

Orchard and Garden Notes

By Edward E. Pescott, F.L.S.

The Flower Garden.

THE popularity of rhododendrons and azaleas has increased by leaps and bounds in recent years, so that nurserymen now sell thousands where previously they sold only a few. The azalea is somewhat hardier than the rhododendron and can stand rather more sun. Both are lovers of semi-shade conditions, and should be planted where they will have shelter from the afternoon summer sun. Both dislike wind, especially north and east winds.

They thrive best in beds where there are plants having similar requirements. Azaleas are excellent subjects for culture in large pots or tubs. They all like a somewhat acid soil; therefore should never be given lime. If a corrective to fungous troubles is required, the soil should be given a light sprinkling of powdered sulphate of iron.

The ground must be well drained. Old red volcanic soil is very suitable. The plants should have an early annual top-dressing of leaf mould, to which a small supply of bone dust has been added. Cow and sheep manures are excellent for a summer dressing.

During summer, the plants should never be allowed to become dry. They should be sprayed in early summer with nicotine sulphate for thrips and red spider. Being surface-rooting plants, digging should never be done near them.

The Orchard.

The attack against codling moth should now be in full swing. There is every appearance of a good crop of apples and pears. From reports it appears that the moths are in flight very early, so there is a possibility of an abundant first brood.

A calyx spray, particularly to apples, should have been given at an appropriate time and followed by a second calyx spray from seven to ten days later, with 5lb. paste or 2½lb. powder arsenate of lead to 80 gallons of water.

Azaleas.

These sprays must be now followed on with a number of cover sprays, the timing of which must be determined by the aid of the lures. The presence of moths in the lures will indicate the prevalence and population of the pest in orchards, and this is a guide to spraying. As eggs hatch from ten days after being laid, judgment should be used in applying the sprays. The important point is to keep the fruit covered with spray, and so protected from larval attack.

Growers may use either the arsenate of lead spray, the white oil spray, or a combination of both. The white oil is an ovicide, and on that account is a valuable adjunct to the spray programme.

Growers should apply to the Horticultural Division for a copy of circular No. 9, which contains full advice for codling moth control.

The Vegetable Garden.

So long as asparagus beds are being cut over they should be kept free from weeds; they should also be well watered. Cutting should cease by the first week in December, and the bed then well manured and the plants allowed to come into full growth. If any plants show a tendency to produce excessive seed, it will pay to remove these and put young plants in their place. Heavy seed-producing, or female plants, are not usually productive of abundant stem growth.

Tomato plants should be well manured and watered. In the home garden it pays to stake and prune them, and thin out many of the

weak side shoots that come in the axils of the leaves. The Departmental leaflet on tomato experiments should be consulted as to the varying treatment of plants and varieties in the field.

All plants of the melon, marrow, and cucumber family should also be manured and freely watered. The ends of the long runners should be pinched off, so that the plants will produce laterals for fruit production.

French beans, both climbers and bush types, may now be freely sown; the seeds should be sprinkled with lime before they are covered with the soil.

Wool Production and Trade 1936-37

PRODUCTION of wool in the chief exporting countries was slightly higher in the 1936-37 season than in 1935-36, according to estimates published in the Imperial Economic Committee's annual review, "Wool Production and Trade, 1936-37." The chief increases took place in Australia (+ 40 million lb.); Union of South Africa (+ 35 million lb.); and Argentina (+ 19 million lb.).

Despite the improved supply position, wool prices showed a sharp advance during the season, the rise in crossbred values being particularly marked. While this movement in wool values was partly in sympathy with the general rise in commodity prices, intensified demand on the part of consuming countries was responsible for much of the increase and precluded major price fluctuations.

Important changes took place in the buying policy of consuming countries and the demand position developed along somewhat unusual lines. The trade dispute with Australia reduced Japanese purchases there to negligible proportions during the first half (July-December) of the season, while Japan dominated the South African and South American markets. Japanese operations also contributed to the sharp rise in New Zealand crossbreds. Japan returned to the Australian market in January, though on a somewhat reduced scale. Increased United States interest in "clothing and combing" wools largely compensated for the lack of Japanese competition in Australia. Unusually large quantities of these wools were also purchased in South America, in addition to the usual "carpet" wool requirements. The high prices paid by Japanese buyers caused a certain part of the usual United Kingdom demand for South African merinos to be deflected to Australia, while the keen world demand for crossbreds also caused a reduction in the proportion of the New Zealand clip shipped to the United Kingdom. Germany was hampered by the competition of Japan in South Africa and South America, and took slightly increased amounts from Australia. Belgium and Italy also increased their purchases in this country. The generally reduced activity in the French wool textile industry caused a further reduction in the amount of wool required and imports were the lowest for many years.

These changes in demand were largely complementary in effect, and the resultant pressure was apparent in the maintenance of wool prices despite world economic and political complications, and in the low level of unsold stocks in all selling centres at the end of the season. In Australia stocks at 30th June aggregated 14,000,000 lb., as compared with 23,000,000 lb. a year earlier. During the same period, New Zealand stocks fell from 17,000,000 lb. to 11,000,000 lb., the greater part of which was disposed of in July and August. Unsold stocks in South Africa at the end of the season were negligible. While the South American season does not nominally close until the end of September, trade reports indicate that the bulk of the clip was cleared earlier than usual, and unsold stocks, particularly of coarse wools, are very small.

Malting Barley Investigations, 1930-36

By Alan R. Raw, M.Agr.Sc., Cereal Geneticist

THE average annual production of malting barley in Victoria approximates very closely to 1,000,000 bushels. This amount of grain would be barely sufficient to meet the requirements of local maltsters, but, owing to the fact that a large proportion of the crop is invariably of inferior malting quality, merchants and maltsters are forced to supplement their supplies with barley from other States, chiefly from South Australia. While the falling off in quality of the local product is, in many cases, due to the influence of environmental factors which are beyond the control of the grower, there can be no doubt that the quality and, therefore, the value of the majority of the samples, could be greatly enhanced by the exercise of greater judgment and care on the part of the grower, particularly at harvest time.

Any improvement in the malting quality of the local product as a whole would be of advantage not only to the grower, but also to the maltster and to the State. There appears to be no sound reason why Victoria, in addition to supplying her own local requirements, should not participate in an export trade, which, though restricted, undoubtedly exists for barleys of the Goldthorpe type.

There is, without question, room for expansion of the industry, but it must essentially be accompanied by an improvement in the quality of the product. Such an expansion may be achieved by increasing the acreage sown to the crop, and/or by increasing the average yield per acre, either by the introduction of improved cultural methods, or by the use of new, superior varieties for cropping.

Despite the importance of the malting barley crop, surprisingly little investigational work has been conducted in the past with a view to improving its quality or yield. This has been due mainly to the fact that the barley plant itself is characterized by an extraordinary degree of adaptability to an extremely wide range of environmental conditions, and because of this, imported varieties have lent themselves to satisfactory cultivation under local conditions. With the exception of isolated variety trials to determine those types best suited to the local environment, this field of research has remained untouched. Sporadic attempts have been made to improve existing varieties by hybridization and/or selection, but, of the varieties cultivated at the present time none are of local origin, a fact which indicates the lack of success in this direction.

The Victorian crop to-day consists of one main variety—Pryor (*Hordeum distichon nutans*), with three or four subsidiary ones, of which the variety Plumage Archer (*H. d. erectum*) is undoubtedly the most important.

Investigations.

With the object of improving the quality and yield of the Victorian malting barley crop a scheme of investigation was drawn up in 1930. This scheme embraced a study of the factors, both environmental and physiological, influencing malting quality and yield in barley, and included a comprehensive policy aimed at the improvement of the crop by plant breeding. The main body of the work has been carried out at the State Research Farm, Werribee (Central District), with varietal observation plots located at Walpeup, Rainbow (Mallee), Winchelsea (Western Central), Strathkellar (Western), and Newhaven (Phillip Island). The scheme may be briefly summarized as follows:—

I. Factors Influencing Quality and/or Yield—

A. Environmental—(i) Season and District.
(ii) Manuring.
(iii) Cultural.

B. Physiological—(i) Variety.

II. Crop Improvement—

(i) Introduction.
(ii) Hybridization and/or Selection.

Adverse weather conditions during 1931 made it impossible to put the whole scheme into operation, and in this season investigations were confined to varietal comparisons in regard to quality, and to the initiation of the breeding programme. In 1932 the full programme was adhered to, but seasonal failure was experienced with the stubble-sown section.

Throughout the entire investigations sympathetic interest in the work has been shown by the local maltsters. Thanks are due to Mr. A. O. Barrett, of Barrett Brothers, and Burston Proprietary Limited, Melbourne, who in 1933 personally conducted several small scale malting tests on plot samples, and to Mr. J. Mitchell, of Smith, Mitchell, and Company, Richmond, for advice in evaluating samples from the plots. All chemical determinations in connexion with the investigations were carried out by the Agricultural Research Chemist (Mr. W. R. Jewell).

All phases of the investigations involving drill-sown plots are based upon four replications of a one-fortieth-acre unit. Standard methods of cultivation and harvesting were adopted throughout.

The total nitrogen content of the grain has been adopted as furnishing the most accurate indication of malting quality. It was found that this figure agreed with the opinion of practical maltsters, and only in rare instances was there any discrepancy between their placings of the samples as regards quality, and the position as indicated by the total nitrogen content of the grain.

FACTORS INFLUENCING QUALITY AND/OR YIELD.

Season.

Effect Upon Yield.—Environmental conditions constitute a group of factors which exert an extraordinary influence upon the reproductive capacity of the plant as indicated by its yielding ability. Any modification of these conditions is reflected in an immediate response on the part of the plant which strives to adapt itself to the change. Of paramount importance among this group of external factors are those closely related ones which in aggregation constitute climate and season. Climate undoubtedly exerts a greater influence upon yielding capacity than does any other group of factors.

Seasonal conditions, being naturally bound up with those of climate also exert a tremendous influence upon yield. In this group rainfall appears to be the factor of major importance, and in this regard it is incidence rather than total precipitation which is of greatest significance. Spring rainfall, or to be more precise, the precipitation in late September-October appears to be of major importance in determining the yield of barley at Werribee. A well-distributed annual rainfall is naturally essential for the preparation of the land, for seeding, and for the establishment of the plant, and any modification in the incidence of the annual precipitation is reflected to a greater or lesser degree in the yield of the crop.

An intensive study of the relationship existing between incidence of rainfall and yield of barley at Werribee during the period 1921-35 has resulted in the establishment of definite correlations, Figs. I. and II., in which "r" attains a maximum of $+ .732 \pm .034$ for Pryor barley (*H. d. nutans*), and $.785 \pm .025$ for Cape (*H. v. pallidum*) for the period from

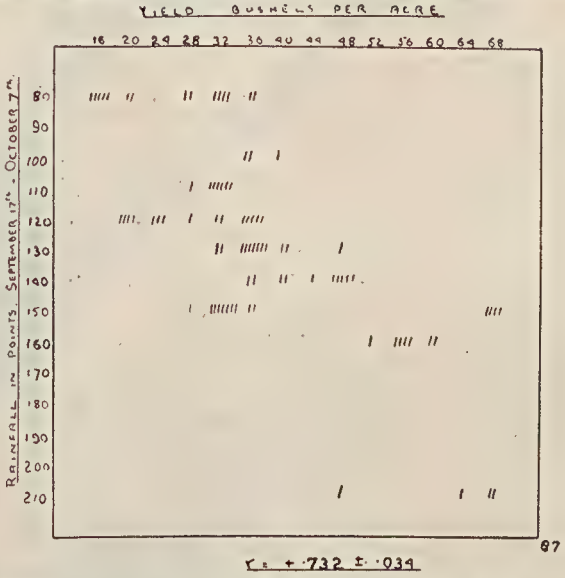

Fig. I.—Correlation table—yield per acre and rainfall. Pryor Barley, Werribee, 1921-1935.

17th September to 7th October. These particular correlations are of extraordinary interest since they furnish definite evidence in support of the critical period theory of Van de Sande Bakhuyzen, Alsberg[1] and Maximov[2]. This period occurring at, or just prior to, flowering is characterized by excessive transpiration losses, which result primarily in physiological modifications of cell activity, and ultimately in the death of the plant. It is obvious, then, that dry conditions at this stage will result in an adverse effect upon yield since such conditions will tend to intensify the strain under which the plant is labouring. On the other hand, cool, moist conditions during the flowering period, by relieving the strain upon the plant, will naturally tend towards increased yields.

While a high degree of correlation exists between rainfall at this period and the final yield it would naturally be unwise to assume that this represents the whole of the picture. It must be fairly obvious that the occurrence of intensely unfavorable conditions prior to this stage cannot be fully compensated for by the rainfall during the critical period. Similarly, the conditions prevailing during the period from flowering to maturity may, and do exert an appreciable influence upon yield. Cool moist conditions during this period are essential to the full development of the grain, and any prolongation of the period naturally

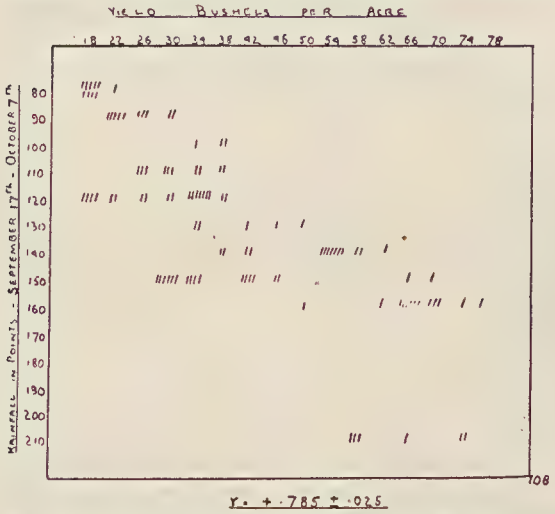

Fig. II.—Correlation table—yield per acre and rainfall. Cape Barley, Werribee, 1921-1935.

results in an increased yield. On the other hand, excessively high temperatures during the first five or six weeks of this period, particularly if accompanied by strong winds, may have the effect, by increasing moisture losses, of bringing about the premature death of the plant, resulting in a reduction in yield. In this regard plants growing on fallow land generally suffer to a greater extent than those growing on stubble, a fact which is due to the relatively excessive amount of vegetation produced by the former.

There can be no question but that rainfall, temperature, and yield are closely related, or that the first two, either separately or in conjunction, exert a tremendous influence upon the third. At the same time, there can be no doubt that spring rainfall exerts a much greater influence upon the yield of barley at Werribee than does any other single factor. From a study of census data, Table III., compiled during the seasons 1932-35, it becomes apparent that September precipitation bears a definite relationship to ear size, and therefore to yield. On the other hand the relationship of rainfall incidence to the number of ears produced by the plant is not so clear. In 1934, when ear production attained a maximum, heavy October precipitations were responsible for the continuation of ear formation until late November. Under normal

Table I.—Seasonal Yields of Pryor Barley.

State Research Farm, Werribee, 1921 to 1936.

Season.	Rainfall.			Yield.
	Feb. to April.	June to Aug.	Sept. to Oct.	
	points.	points.	points.	bushels per acre.
1921	−277	+ 34	+118	+24·7
1922	−114	+ 69	+134	+ 9·1
1923	−411	+ 79	+145	N.A.
1924	+353	+ 76	+ 85	+19·0
1925	−296	− 74	−147	−10·0
1926	−243	− 40	− 80	− 3·7
1927	−295	− 23	− 94	−17·2
1928	+274	−219	−140	−22·3
1929	+ 12	− 70	− 82	−10·0
1930	− 93	+ 70	− 71	− 4·9
1931	+324	+126	−118	N.A.
1932	+507	+ 8	+ 44	−12·9
1933	−257	+ 48	−121	− 3·1
1934	+144	− 78	+228	+28·2
1935	+365	− 3	+102	+ 2·5
1936	−107	+336	− 88	0·0
Mean values 1921 to 1935	477	461	352	38·3

seasonal conditions, however, it is probable that ear formation is determined prior to October.

While the influence of spring rainfall upon yield is readily apparent, that of autumn precipitations is not so well defined. Excessive rainfall during this period may exert a depressing effect upon yield. Exceptionally wet autumn conditions may be responsible for a number of complications, waterlogging of soil, limited nitrification, leaching, and excessive weed growth, resulting in a soil nitrate deficiency at seeding, a condition which will be reflected in the ultimate yield of the crop. Such conditions were experienced at Werribee during the seasons 1932 and 1935, when a marked response to nitrogenous fertilizers on fallow land was observed in the barley

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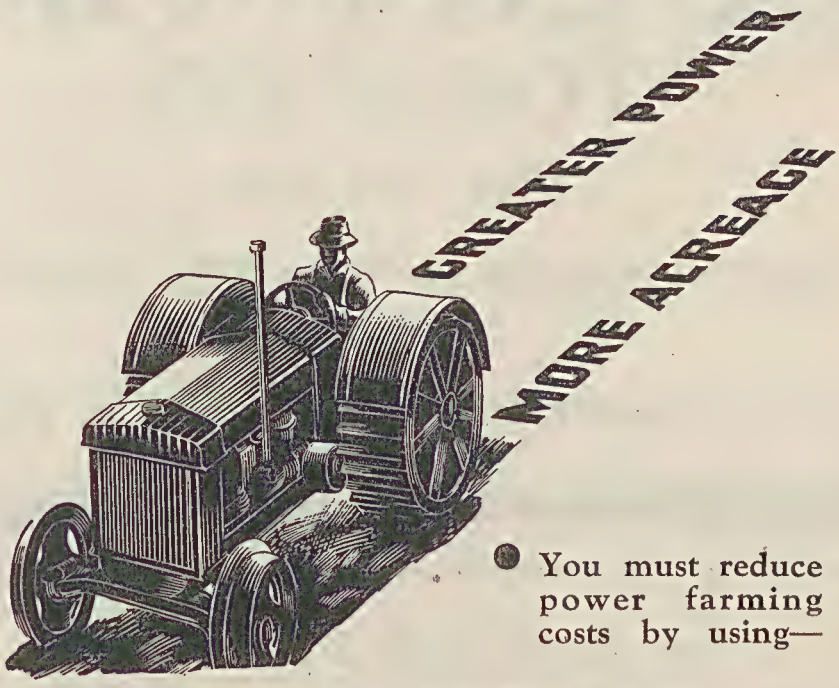

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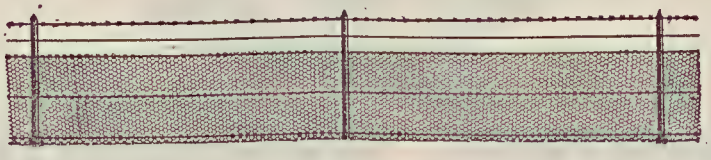

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manurial trials. From a study of the data available, Table I., it appears probable that such deficiencies occur at Werribee once in every three or four years.

A further seasonal factor which may exercise a detrimental effect upon yield is the occurrence of frosts at flowering. These, of course, tend to exert a lethal effect upon the reproductive organs of the plant. A survey of the yields of malting barley on fallow land at Werribee during the period 1921 to 1936 indicates the very close relationship existing between spring rainfall and yield. In Table I. rainfall and yield are expressed in terms of their variation from the mean values for the period. Yield figures are not available for the season 1923, when the crop was sown on stubble land, or for 1931, when excessive autumn and winter rainfall made seeding impossible.

On five occasions only during the fourteen years under review has the yield figure been in excess of the average, and in each of these cases the increase in yield may be directly attributed to the rainfall, and particularly to its September-October incidence. In addition, the conditions prevailing during the period from flowering to maturity were in each case mild and conducive to slow ripening and to the full development of the plant. Following upon the three good seasons 1921, 1922, and 1924, sub-average yields were recorded upon eight successive occasions. With one exception the spring rainfall in each of these seasons was below normal. During this period the lowest yield recorded was 16 bushels per acre, in 1928, a variation from the average of 58 per cent. In this season the winter rainfall was 200 points below normal, and this, in combination with a deficiency of 130 points for the September-October period, was undoubtedly responsible for the low yield obtained. In the light of more recent experience it is also probable that the excessive autumn rains in this year exerted a further depressing effect upon the yield.

The seasons 1925 to 1927 were also very dry, the anual precipitation in each case being from 5 to 6 inches below the average. In each of the seasons 1926 to 1929 crops received a severe check through the prevalence of adverse weather conditions, involving high temperatures and strong winds during the period from flowering to maturity. The seasons 1932 to 1936, during which detailed investigations have been in progress, represent several very distinct types. These are considered in detail below. Rainfall data for the period are presented in Table II.

Seasons 1932 *and* 1935.—These seasons were strikingly similar as regards rainfall incidence, particularly in the first six months. In each case excessive autumn rainfall, causing waterlogging of the soil, was responsible for the cessation of normal cultivation. As a result, the condition of the soil just prior to seeding was exceedingly rough. In addition, weed growth, chiefly Cape weed (*Cryptostemma calendulaceum*), was excessive, and it was only

Table II.—Meteorological Data 1932 to 1936.

Month.	Rainfall.					
	Monthly Average 1921 to 1935.	Monthly.				
		1932.	1933.	1934.	1935.	1936.
	points.	points.	points.	points.	points.	points.
January	126	1	56	222	174	62
February	123	224	24	137	137	44
March ..	184	449	90	21	180	50
April ..	164	311	106	463	525	276
May ..	159	82	154	18	103	76
June ..	140	107	87	110	153	223
July ..	138	130	272	91	126	419
August ..	166	232	150	182	179	155
September	179	57	109	138	201	93
October	206	339	122	442	253	171
November	183	46	200	417	119	137
December	193	306	329	256	91	314
Total	1,961	2,284	1,699	2,497	2,241	2,020

with difficulty that the ground could be cleaned sufficiently to allow of seeding. These conditions resulted in a deficiency of soil nitrate, a fact which was demonstrated by the response of plants to dressings of sulphate of ammonia. Soil analyses in 1935 indicated the nitrate content of the typical fallow as less than one-third normal.

In each year seeding operations were completed by mid-June, and subsequent rains, though sub-normal, were sufficient to ensure good germination and satisfactory plant establishment and development by the end of August. From this time onward the weather conditions prevailing in each season were essentially dissimilar. In 1932 the month of September was abnormally dry, but the mild conditions prevailing enabled crops to make good progress before the effects of the soil

Sowing the Barley Crop.

moisture shortage became apparent. The rainfall during the critical period, as indicated by the correlations, was 21 points, but a fall of 240 points during the second week in October was responsible for preventing what would otherwise have been an almost complete failure of the crops. From this time until maturity, conditions generally were extremely mild, and favoured the full development of the crop, which attained maturity during the first week in December. The exceptional feature of the season was the absence of hot northerly winds, which are characteristic of the district during the latter portion of the year, and which naturally exert an extremely adverse effect upon the barley crop.

The yields on fallow land for this season were in the region of 27 bushels per acre from crops receiving a manurial dressing of 1½ cwt. of superphosphate per acre—the standard dressing throughout these investigations. Crop census investigations, Table III., revealed that these low yields were due to the small number of ears produced per foot of drill row, coupled with the relatively small size of the individual ear. On the other hand, grain size was extraordinarily high, reflecting the favorable conditions for development which prevailed during the latter portion of the growing period. The reduction in yield was directly attributable to the nitrate deficiency of the fallows at seeding, and to the dry conditions prevailing during September and early October. The application of sulphate of ammonia as a fertilizer in this season raised the yield level by more than 10 bushels per acre.

In 1935 comparatively normal conditions during August were followed by exceptionally good September-October rains, and the conditions prevailing during this period enabled the plants to develop to their fullest extent. This advantage was offset to some extent by the occurrence of strong northerly winds, with temperatures in excess of 80°F., on five separate occasions during October. Mild conditions were experienced during November and early December, and the final ripening of the crop was relatively slow, full maturity being reached during the first week in December. The yields in this season were in the region of 41 bushels per acre, 3 bushels in excess of the average. The crop census investigations revealed that the increase over the 1932 level was due primarily to an increase of 35 per cent. in the number of ears per foot, and 25 per cent. in ear size. On the other hand, grain size was depressed by 10 per cent. owing to the relatively adverse conditions experienced during October operating against the full development of the grain.

Table III.—Crop Census Investigations.

Pryor Barley—Fallow sown, 1932 to 1935.

Season.	Number of Ears per Foot.	Number of Grains per Ear.	Weight per 1,000 Grains.	Yield per Acre.
			grams.	bushels.
1932	9·9	16·3	50·3	26·9
1933	14·9	18·2	41·7	37·2
1934	22·7	17·1	48·3	61·9
1935	13·4	20·1	45·5	40·8

During this season the nitrate deficiency at seeding was undoubtedly responsible for a primary depression in yield. On the other hand, conditions during the spring months were such as to induce exceptionally high yields. As a result of the interaction of these two diametrically opposed series, average yields were recorded, though the effect of the excessive autumn rainfall was still apparent.

Seasons 1933 *and* 1936.—The weather conditions prevailing during these seasons were, in general, very similar. In each case the early portion of the year was phenomenally dry, and difficulties in the effective cultivation of the fallows were experienced on this account. Good rains were experienced in April and May, enabling seeding operations to be completed during the first week in June under relatively good conditions. In both seasons the rainfall, during the period June to August, was in excess of normal. The winter of 1936 was the wettest on record. Germination under these conditions was relatively slow, but even, and the mild conditions prevailing enabled the plants to become established, and to make excellent growth up to the end of September.

In 1933 the September rainfall was below normal, but 139 points during the late September-early October critical period, enabled the crops to develop rapidly until late October, when they received a severe check on account of the extremely dry conditions which were experienced at this stage. This period was characterized by extraordinarily high temperatures, in association with strong northerly winds. The average maximum temperature for the month of October was several degrees in excess of normal, while the evaporation figure showed a corresponding increase. On five occasions during October, and upon two during November, very strong northerlies were experienced, and temperatures rose above 80°F. An exceptionally strong wind, associated with a temperature of 94°F., on 23rd October was responsible for excessive damage to crops, and marked the onset of the final stages of premature ripening.

Under these conditions, crops were ready for harvesting by the third week in November. The yields on fallow land in this season were in the region of 34 bushels per acre, the increase over the 1932 level being due primarily to an increase of 50 per cent. in the number of ears produced per foot of drill row, and 12 per cent. in ear size. On the other hand, owing to the extremely unfavorable conditions which prevailed during the maturation period, grain size was depressed by approximately 12 per cent.

In comparison with the average, the slight depression in yield in this season was undoubtedly attributable to the severe conditions prevailing during the flowering-maturity period. At the time of flowering plants gave every indication of yielding in excess of the average, but by the end of October, the effect of the severe conditions—lack of moisture, high temperatures, and strong winds—was apparent, and there can be no doubt but that the conditions prevailing during this month were mainly responsible for the reduced yield.

In 1936 low rainfall conditions were again experienced in September and early October, only 42 points being recorded during the critical period. Despite this, the mild conditions prevailing during these months, and continuing until harvest, in mid-December, prevented any serious damage to crops. Valuable showers were experienced during late October and November, and, in the absence of hot winds, crops matured slowly. As a result of these conditions, average yields were obtained from fallow crops. No census data are available for this season, but from observation it was apparent that the main increase in yield over the 1932 level was brought about by the marked increase in the numbers of ears produced per foot of drill row. The development of the grain, as indicated by its weight, while not so marked as in 1932, was better than in 1933. This was due to the milder conditions experienced during the maturation period of 1936.

Season 1934.—The seasonal characteristics of 1934 differed widely from those of the four seasons already discussed. During the first two months of the year the rainfall was in excess of normal. This was followed by an exceptionally hot dry spell in April, during which month cultivation was carried forward. The rainfall for the period May to July was below normal, but sufficient moisture was available to ensure a good germination subsequent to seeding in mid-June. Plants made little progress until the latter end of August, when relatively heavy rains were experienced. The rainfall during the September-October critical period was 142 points, and this enabled the plants to develop rapidly.

Excessive rains, accompanied by mild temperatures, and the absence of hot winds characterized the maturation period. These conditions, which prevailed until mid-December, when the advent of hot weather was responsible for speeding up the final rate of maturity of the crop, had the effect of inducing excessive late vegetative development of the plants, and enabled them to complete their development under ideal conditions, thus resulting in exceptionally heavy yields. The

fallow yields for this season were in the region of 66 bushels per acre, the increase over the 1932 level being achieved primarily by an increase of 129 per cent. in the number of ears produced per foot of drill row. Ear size also showed a slight increase, while grain size attained a level almost equal to that observed in 1932.

These high yields, which were 28 bushels in excess of the average, were undoubtedly due to the extraordinary conditions prevailing during the latter portion of the growing period. These conditions, by prolonging the period of maturity, enabled the plant to develop to its fullest extent, and to produce a maximum amount of well developed grain.

From a study of the above data it is obvious that, during the five seasons under consideration, several factors have been operating to determine the yield of the plant. Of these, rainfall has been of prime importance, either directly or indirectly, but other factors have exerted a very definite influence.

The importance of the September-October rainfall is at once apparent, and there can be doubt that this exerts the greatest effect upon yield of any single seasonal factor. This fact is amply borne out by the established correlations, Figs. I. and II.

The effect at this period appears to be mainly upon ear size, and, under exceptional circumstances, upon the number of ears produced by the plant—the two most important factors in determining yield. Under normal conditions the number of ears per plant is probably determined by the August-September conditions. Plant establishment, on the other hand, is mainly determined by the June-August conditions, but it is doubtful whether this factor has any marked effect upon the yield of barley since the plant is possessed of such a remarkable degree of adaptability, that, under normal circumstances, any reduction in the establishment percentage is compensated for by an increase in stooling.

Conditions prevailing during the period between flowering and maturity also exert a marked effect upon yield. Cool moist conditions, such as were experienced during the season 1934, tend to increase the final yield of the plant. On the other hand, severe, hot, dry conditions, tending to induce premature ripening, have the reverse effect.

Probably the second most important factor operating to determine yield in fallow-sown barley at Werribee is autumn rainfall. As indicated by the results obtained during the five seasons under investigation, excessive autumn rains exert a depressing effect. This introduces an entirely new concept into the problem of yield under local conditions, and at once suggests the possibility of counteracting such effects by the use of nitrogenous fertilizers for fallow-sown cereals in these seasons. The whole problem requires further investigation, but at the present juncture there appears to be little doubt regarding the possibility of forecasting those seasons in which the use of nitrogenous fertilizers will be an economically sound proposition for fallow-sown cereals. From a study of the data presented in Table I., it will be seen that excessive autumn precipitations were recorded during the years 1924, 1928, 1931, 1932, and 1935, and in light of the evidence obtained during the latter two seasons, it seems reasonable to assume that a curtailment of supplies of soil nitrate at seeding would be experienced in each of these seasons.

In other words it is reasonably safe to assume that, under local conditions, autumn rainfall influences yield once in three years. This aspect of the investigations is referred to in greater detail in the manurial section of this paper.

Effect Upon Nitrogen Content.—The total nitrogen content of the grain may be accepted as offering the most reliable, measurable index to its malting quality. The barley grain is composed of four main groups of constituents of which the starch and nitrogen compounds are the most important. The starch, which comprises from 60 to 70 per cent. of the grain, is essentially the most important constituent from the viewpoint of the maltster and brewer, since it furnishes the chief source of the sugars and alcohol. In the absence of any simple method of accurately estimating the starch content of the grain, attention has been diverted to the second major group of grain constituents—the nitrogen compounds— as a means of determining malting quality.

The nitrogen compounds of the grain, which are easily estimable, consist, in addition to several relatively unimportant and less complex substances, of four proteins—an albumen, a globulin, a glutelin, and a hordein—of which the latter is the most important. According to the recent findings of Bishop (3, 4, 5), the amounts of the various proteins present in the mature grain are closely related to its total nitrogen content, and for any given total

nitrogen figure, it is possible to state the percentage of the individual proteins present in any given variety. The proportion of the different proteins therefore is dependent upon the percentage of nitrogen present in the grain, irrespective of its source. There is a very close relationship between the proteins of the barley grain and those of the malt produced from it. Each of the four malt proteins is similar to the corresponding one in the grain, and because of this a very definite relationship exists between the total nitrogen content of the grain and the quality of the malt produced from it.

During recent years a prediction formula, based upon the relationship existing between total nitrogen content, grain weight, and extract, has been evolved by Bishop in England. By the adoption of this it is now possible to predict the amount of extract that will be obtained from any given sample of barley of known variety, for which the total nitrogen content and individual grain weight are known.

In the equation, $E = A - 10.5\ N + 0.2\ G$, E equals the amount of extract in brewers pounds per quarter of dry malt, N the nitrogen percentage, and G the weight per 1,000 grains. The value of A, which is a constant for a given variety is determined by experimentation.

As the value for N increases that for E shows a corresponding decrease. The nitrogen figure is a purely relative one, which is dependent upon the amount of starch present in the grain. Thus, on account of the nitrogen: protein relationship, an increase of one unit in the former, means a decrease in the starch content of approximately six times that amount. In addition, it has been shown that as the nitrogen figure increases, the availability of the starch is affected and extraction becomes more difficult. Apart from influencing the amount of extract produced, the nitrogen content of the grain is of further importance since it exerts a very great influence upon the flavour and the keeping qualities of the resultant beers.

The relationship existing between the second factor in the prediction formula, grain weight, and extract is readily apparent since small grains will have more husk and structure material, and therefore relatively less starch than the larger ones.

The total nitrogen content of the grain varies greatly with changing environmental conditions. Since this character is so closely bound up with that of malting quality, it is desirable that the actual effect of the various environmental factors be understood.

For the purpose of studying the seasonal effect upon the total nitrogen content of the grain a series of plots was sown at Werribee during the six seasons 1931 to 1936. Two varieties—Pryor and Plumage Archer, representing the Chevallier and Goldthorpe types respectively—were selected for this purpose, and were grown on fallow under identical

Threshing produce from the barley plots at the State Research Farm.

conditions each year. The results, Table IV., indicate the very definite effect exerted by seasonal conditions upon total nitrogen content.

TABLE IV.—EFFECT OF SEASON UPON TOTAL NITROGEN CONTENT.

Variety.	Grain Nitrogen.					
	1931.	1932.	1933.	1934.	1935.	1936.
	%	%	%	%	%	%
Pryor ..	1·48	1·25	1·43	1·38	1·40	1·36
Plumage Archer ..	1·37	1·06	1·34	1·16	1·30	1·27

One of the outstanding features of the results is the difference existing in nitrogen levels between the two varieties. This will be considered in detail later in connexion with the varietal influence upon yield and quality.

In considering the results in detail it will be observed that in three seasons—1932, 1934, and 1936—grain nitrogen levels were relatively low compared with those recorded in the remaining three seasons. These differences are strikingly illustrated by the graphical presentation of the results, Fig. III.

It is significant that each of these seasons was characterized by the prevalence of mild conditions during the maturation period. In 1932 the total nitrogen content of the grain was exceptionally low for fallow sown crops. The effect of the nitrate deficiency in this season is obscure, but apparently it had little bearing upon the final nitrogen content of the grain, since samples from plots receiving manurial dressings equivalent to 24 lb. of nitrogen per acre were similar in this respect to those from the "superphosphate 1½ cwt. per acre" plots. It appears from this, that, under these conditions, any increase in the amount of nitrogen available to the plant during the early stages of growth will be reflected in increased yields, rather than in an increase in the final nitrogen content of the grain, the increased nitrogen intake being compensated for by the increased number of grains produced by the plant. Further, the extra development of the plant, induced by such manurial dressings, naturally allows of greater carbohydrate synthesis. The cool moist conditions prevailing during the maturation period had the effect of prolonging this period by slowing up the final rate of ripening, and thus ensured full development of the grain (Table IV.). Consequently carbohydrate formaton attained a maximum, and grain samples in this season were of exceptionally good malting quality.

During 1934 the prolongation of the maturation period was carried on into December, when the sudden onset of hot weather was responsible for a check in the physiological activities of the plant, and resulted in the final stages of maturation, and drying out of the grain being accelerated. On this account the resultant sample was of inferior quality to that produced in 1932 when the slow rate of maturation was retained to the end. The 1934 samples were well developed, the 1,000 grain weight being almost as high as in 1932. The total nitrogen content was low, and the bulk of the sample was of undoubtedly good malting quality. The presence in the sample of immature grains, occasioned by the prevalence of secondary

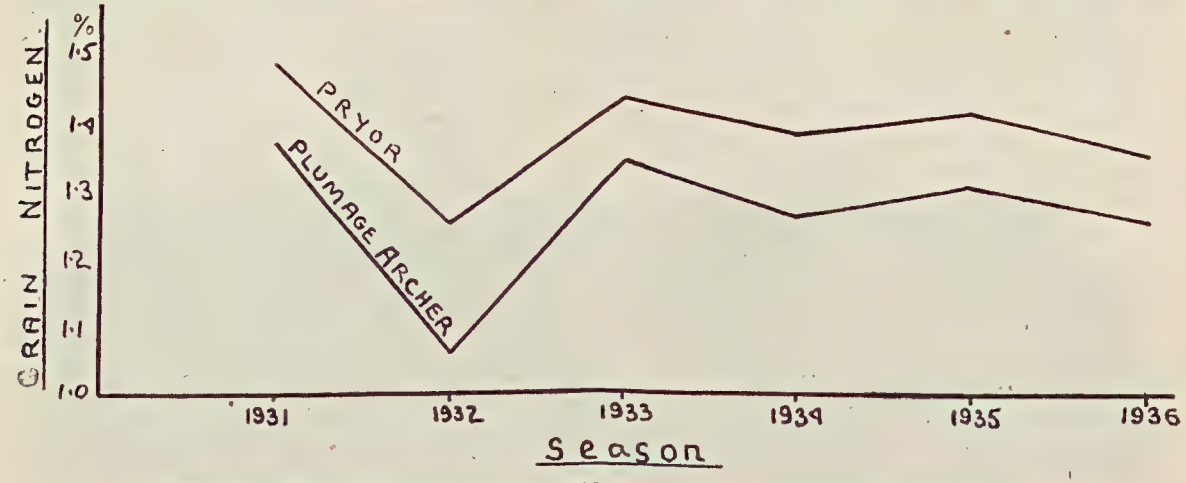

Fig. III.—Effect of season on Grain Nitrogen Content, Werribee, 1931-1935.

ears in the plots, tended to boost its total nitrogen content, and naturally detracted from its value from the maltster's viewpoint, since such an admixture would result in uneven germination and modification during the malting process.

In 1936 conditions during the maturation period were in general mild, but the full development of the grain was impeded by adverse October conditions. As a result, grain nitrogen levels were higher than in 1932, and grain size was depressed. In this season the samples as a whole were of good malting quality.

In each of the remaining three seasons—1931, 1933, and 1935—grain nitrogen levels were relatively high. It is significant that each of these seasons was characterized by the prevalence of adverse conditions subsequent to the flowering period of the plant.

During 1931 excessive autumn rains were experienced, and their occurrence at once suggests a possible nitrate deficiency at seeding. The pre-September rainfall was in excess of normal, but conditions during October and early November were exceptionally dry, and were accompanied by strong northerly winds in association with severe temperatures. As a result, the maturation period of the plant was markedly curtailed, resulting in the premature cessation of carbohydrate deposition. This was reflected in the high nitrogen content of the grain samples, and in the marked depression in grain weight.

During 1933 plant development was practically unimpeded up to the end of the critical period in early October. From the onset of the maturation period, however, extremely severe conditions were experienced, and were once again responsible for the premature death of the plant. As was the case in 1931, the curtailment of the period of carbohydrate deposition was manifest in the high nitrogen level and depressed weight of the grain. In each of these seasons the grain was obviously of inferior malting quality, being particularly unattractive and steely in cross section.

As was the case in 1932, the 1935 season was characterized by a nitrate deficiency in the fallows at seeding. The only marked divergence of conditions from those experienced in 1932 occurred during the maturation period, and to this can be attributed the differences apparent in grain nitrogen levels in the two seasons. During 1935, conditions generally favorable to plant development were experienced during the maturation period, but crops received several definite checks in the month of October. These had the effect of arresting the full development of the grain, and in consequence total nitrogen levels were somewhat in advance of those recorded in 1932, 1934, and 1936. On the other hand, grain weight was not affected to the same degree as in 1931 and 1933 when maturation conditions were more severe.

It is obvious then, from a study of the conditions prevailing during the six seasons under investigation, that the major factor determining the nitrogen content, and hence the malting quality of the grain, is the weather conditions prevailing at and subsequent to flowering. Deficiency of rainfall, and/or conditions conducive to rapid ripening result in high grain nitrogen levels. On the other hand, abundant rainfall, and/or conditions which tend to prolong the maturation period have the reverse effect.

It will be observed that there exists a fairly close similarity between conditions favoring high yield and those favoring low nitrogen content. The reverse also holds true. Where, however, conditions favoring yield and low nitrogen receive a severe check in the latter stages of the maturation period, the relative nitrogen content of the grain may show a sharp rise, whereas the yield figure may not be appreciably affected. In addition, yield may be seriously affected by rainfall during the autumn months, but there is no evidence to suggest the operation of any factors influencing the total nitrogen content of the grain, prior to the September-October period.

The effect of a nitrate deficiency at seeding upon the total nitrogen content of the grain is obscure, and probably of little import under Victorian conditions. There is a wealth of very definite evidence from overseas investigations to indicate that total nitrogen content is dependent primarily upon the nitrogen uptake of the plant, and that weather conditions during the maturation period have little effect upon the percentage of nitrogen present in the grain. Under local conditions the reverse appears to hold true. During the seasons 1932 and 1935, when nitrate deficiencies occurred, the total nitrogen content of the grain reached its lower levels, but in both seasons dressings of nitrogenous fertilizers were responsible for an increase in yield, with a reverse effect upon total nitrogen content. This was, of course, to be expected, since the yield increases were of such magnitude as to balance the extra amount of nitrogen assimilated by the plant. It is

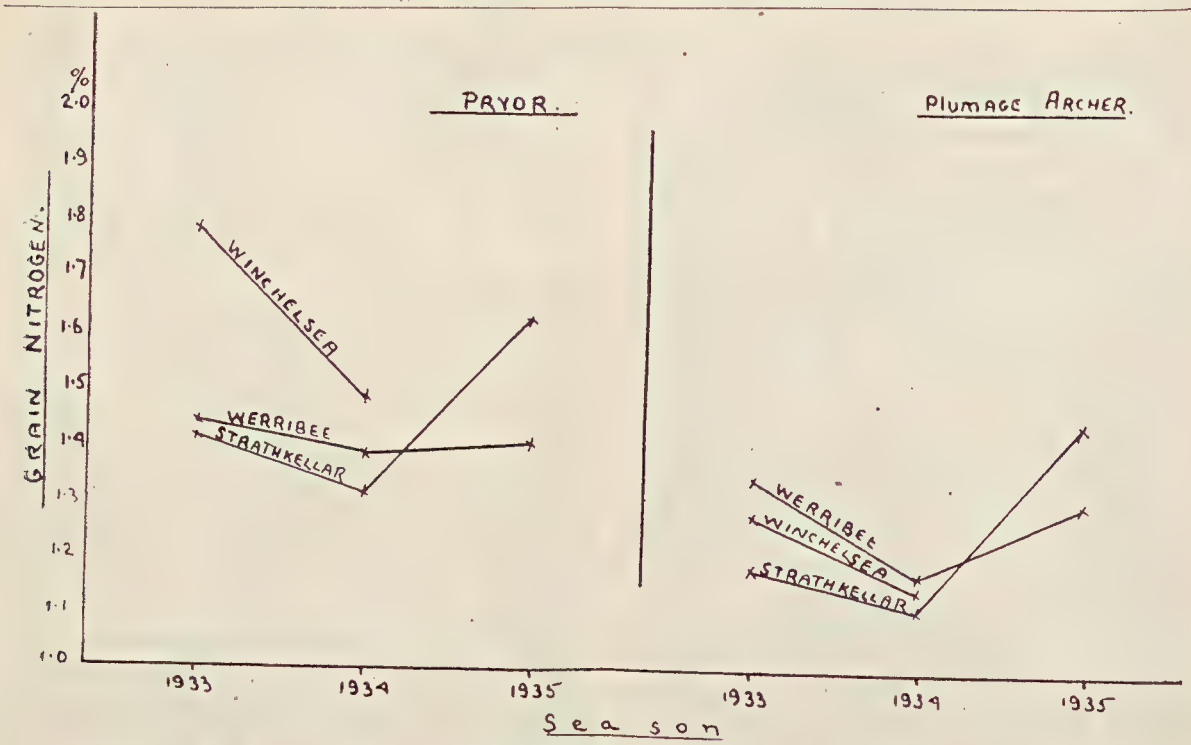

Fig. IV.—Effect of season and district on Grain Nitrogen Content. Winchelsea, Strathkellar, and Werribee, 1933-1935.

highly probable that the typical Victorian barley soil never contains sufficient available nitrogen to materially affect the total nitrogen content of the grain.

The seasonal effect upon total nitrogen content was essentially similar in the case of each of the varieties studied, though the results indicate that Plumage Archer reacts more to unfavorable conditions than does Pryor. This is due to the fact that the former variety is of later maturity, and on this account is exposed to seasonal conditions over a greater period than the latter.

Effect of Season and District.

The effect of season and district upon the nitrogen content of the grain has been indicated by a study of samples from observation plots of Pryor and Plumage Archer barley, located at Winchelsea and Strathkellar, in the Western District. The results which are presented graphically (Fig. IV.) in comparison with the Werribee figures, indicate that in two seasons, 1933 and 1934, the nitrogen content of the grain was lower at Strathkellar than at either Werribee or Winchelsea, thus suggesting the suitability of this centre for the production of malting barley. The high nitrogen level of the Strathkellar samples in 1935 was due to the fact that the plots were sown very late in the season, with the result that the period of development of the plant was markedly curtailed. The general seasonal relationship between the samples held for each of the three seasons. The greatest seasonal variations, exclusive of the 1935 Strathkellar samples, was shown by the Pryor samples from Winchelsea, the 1933 samples being of excessively high total nitrogen content. These results furnish further definite evidence of the enormous effect of seasonal conditions upon the malting quality of the grain.

Effect Upon 1,000 Grain Weight.—Grain size, as indicated by the weight of 1,000 grains is a very definite varietal characteristic, but one which is subject to extensive modification by environmental factors, among which seasonal conditions assume pride of place. Because of this, accurate varietal comparisons can be made only upon material which has been subjected to similar environmental conditions. Generally speaking, in any intra varietal comparisons, the size of the grain may be taken as being indicative of its degree of development. From this it would naturally be concluded that conditions conducive to the

prolongation of the maturation period, would favour the development of larger grains. Furthermore, since these conditions usually bring about a reduction in the nitrogen content of the grain, it would be expected that any increase in grain weight would be indicative of an improvement in the malting quality of the grain itself.

While this is usually true, little reliance can be placed upon grain weight as a guide to quality. Under certain conditions a prolongation of the maturation period may result in an increase in grain size, but the onset of severe conditions during the latter portion of this period, while arriving too late to effect 1,000 grain weight, may result in an increase in the relative nitrogen content of the grain, thus giving rise to a large grain of relatively high protein content.

The effect of seasonal conditions upon the character of 1,000 grain weight was studied at Werribee during the six seasons, 1931 to 1936, in conjunction with the total nitrogen investigations. The results, Table IV. and Fig. V., have already been considered in connexion with the seasonal effect upon grain nitrogen.

TABLE IV.—EFFECT OF SEASON ON GRAIN SIZE.

Variety.	Weight per 1,000 Grains.					
	1931.	1932.	1933.	1934.	1935.	1936
	gms.	gms.	gms.	gms.	gms.	gms.
Pryor ..	41·7	50·5	41·7	48·3	45·5	44·4
Plumage Archer ..	40·3	42·6	40·2	41·5	40·7	37·5

The varietal differences in grain size are discussed later in this report.

The results obtained during the six seasons under consideration indicate weather conditions during the maturation period, as the major seasonal factor dominating grain size in barley. The whole problem is naturally bound up with that of carbohydrate deposition in the grain. Conditions conducive to the extension of the

Fig. V.—Relation between Grain Nitrogen Content and Weight. Werribee, 1931-1935.

maturation period, naturally result in a relatively greater amount of starch being deposited, with the resultant increase in grain weight. The reverse also holds true. The results are in strict accord with the findings of other workers (3, 6, 7, 8, 9, 10).

Summary.

It is obvious that seasonal conditions exert a tremendous influence upon each of the three characters under investigation, and that each may be affected singly, or in association with one or both the other two. Thus, autumn rainfall may exert a modifying effect upon yield, although it apparently bears little relationship to either total nitrogen content or grain size. On the other hand, spring rainfall exercises a very definite effect upon all three, as do the conditions prevailing during the maturation period. The close relationship existing between these three characters is very apparent, and, excepting in those cases in which autumn conditions operate, it appears reasonable to assume that where yield is above the average, the increase will generally be accompanied by corresponding increase in grain size, and an improvement in the malting quality of the grain. This assumption will of course not hold true when severe conditions are experienced late in the maturation period.

The relationship existing between total nitrogen content and grain weight is a much closer one, a fact which is strikingly illustrated in Fig. V. In each case, an increase in grain size has resulted in a corresponding decrease in total nitrogen content, and the reverse also holds true. This is naturally to be expected since any increase in size of grain must be brought about by increased carbohydrate deposition, resulting in a widening of the protein: carbohydrate ratio. The intimate association of these two characters at once suggests their value in determining the relative inherent malting quality of grain samples of any one variety, since, on the one hand, they furnish a definite indication of protein content of the grain, while on the other, they may be taken as being representative of the amount of carbohydrate deposition that has taken place. In conjunction with the visual test of the experienced observer, which takes into account all external characters of the grain, the test should be of very definite value.

The data available is insufficient to allow of the formulation of any accurate basis for predicting yield, total nitrogen content, or grain weight, prior to harvest. The suggestion is made, however, that in most seasons a study of the September-October rainfall, in conjunction with the conditions prevailing throughout the latter month, should enable one to forecast yield reasonably accurately. On the other hand, any attempt to forecast nitrogen content at this stage would be liable to a greater degree of discrepancy.

The occurrence of excessive rainfall precipitations during the autumn months may be taken as indicating a soil nitrate deficiency at seeding, with a consequent reduction in yield; a condition to be overcome by the use of nitrogenous fertilizers for the fallow-sown crop.

Conclusions.

1. There is a marked seasonal effect upon yield, grain nitrogen content, and grain size in barley.

2. The effect upon yield is mainly bound up with spring rainfall, with autumn precipitation as a second factor of major importance.

3. Definite correlations supporting the "critical period theory" have been established between September-October rainfall and yield of barley at Werribee.

4. The conditions prevailing during the maturation period exert the greatest effect upon grain nitrogen content and grain size, and hence upon malting quality. Yield is also affected by these conditions.

5. The three characters exhibit a close relationship one with the other. In general, conditions conducive to increased yields also result in increased grain size, with a corresponding decrease in grain nitrogen content. The relationship, however, does not always hold.

6. Forecasts of yield within moderately narrow limits are possible from a study of September-October rainfall.

7. The possibility of forecasting malting quality is remote.

8. Under local conditions soil nitrate deficiencies occur approximately once in every three seasons.

9. From a study of autumn rainfall precipitation it is possible to forecast those seasons when such deficiencies occur, and to counteract the depressing effect upon yield by the use of nitrogenous fertilizers.

10. The value of grain nitrogen content and grain weight as an index to intra-varietal malting quality is indicated.

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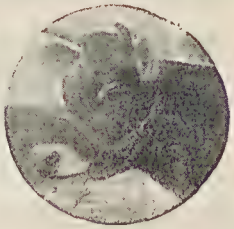

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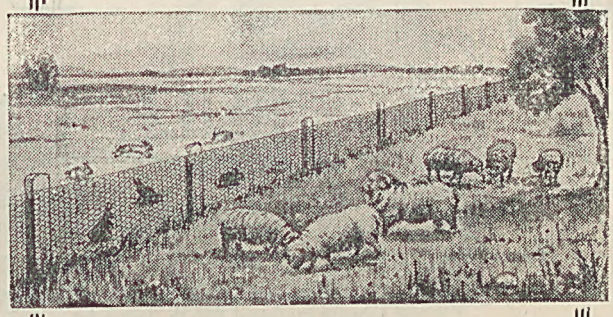

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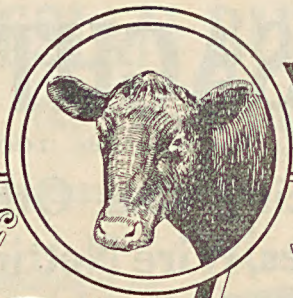

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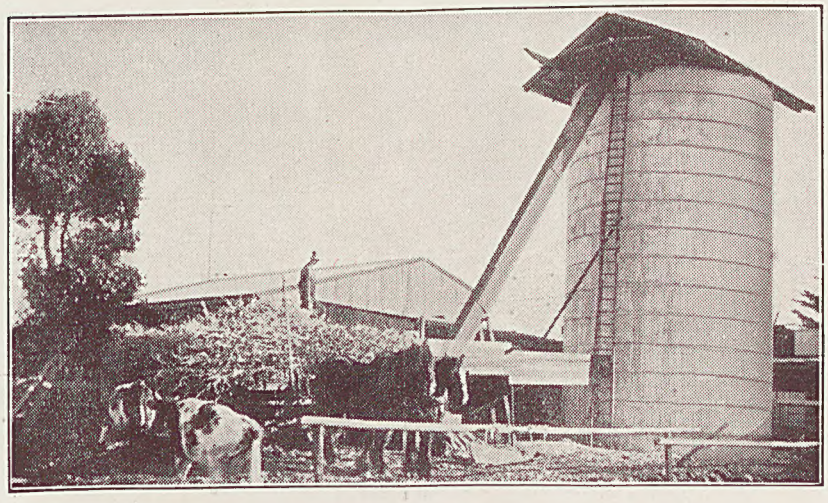

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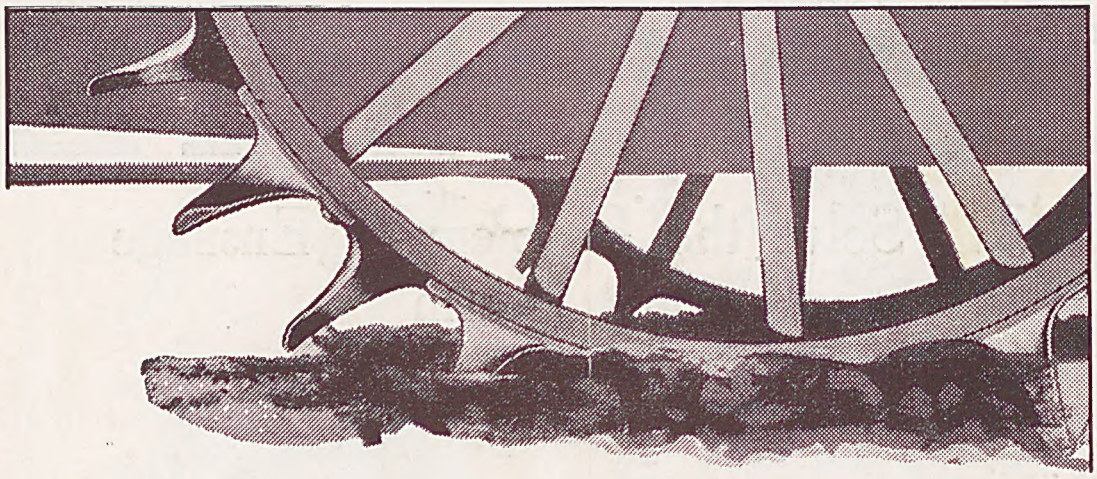

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